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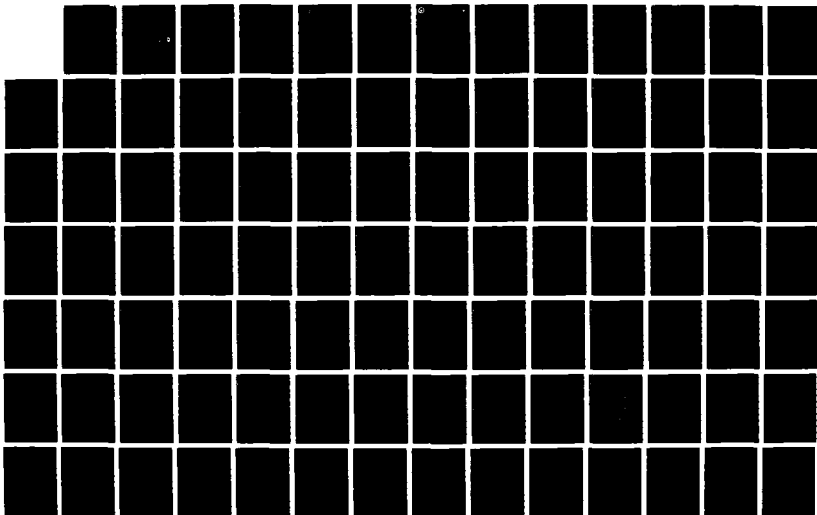
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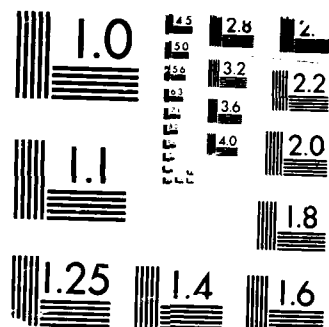
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METHODOLOGY INVESTIGATION

FINAL REPORT

AUTOMATED ANALYSIS AND ENTRY OF U S GENERIC-UNIT DATA

Bell Report No. 87-09-009

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APR 21 1988
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Prepared by

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Prepared for

US ARMY ELECTRONIC PROVING GROUND
Command, Control, Communications, and Intelligence
Data Base Division, STEEP-DT-C

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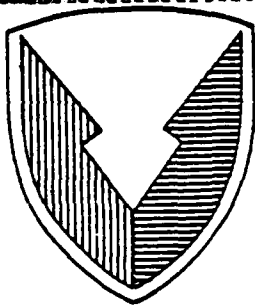
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**USAEPG - PROVIDING LEADERS
THE DECISIVE EDGE**

METHODOLOGY INVESTIGATION

FINAL REPORT

AUTOMATED ANALYSIS AND ENTRY OF U S GENERIC-UNIT DATA

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**BATTLEFIELD ELECTROMAGNETIC ENVIRONMENTS OFFICE
COMMAND, CONTROL, COMMUNICATIONS, AND INTELLIGENCE
DATA BASE DIVISION
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**U.S. ARMY ELECTRONIC PROVING GROUND
Fort Huachuca, Arizona 85613-7110**

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PREPARED FOR:

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Aberdeen Proving Ground, MD 21005-5055**

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31 MAR 1988

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SUBJECT: Transmittal of Final Report-Methodology Investigation
Automated Analysis and Entry of U.S. Generic-Unit Data, TECOM
Project No. 7-CO-R87-EPO-007

1. Subject report is approved.
2. Point of contact, this headquarters, is Mr. Joseph Knox,
AMSTE-TC-M, amstetcm@apg-4.arpa, AV 298-2170/3677.

FOR THE COMMANDER:

GROVER H. SHELTON
Chief, Meth Imprv Div
Directorate for Technology

TABLE OF CONTENTS

FOREWORD	1
--------------------	---

SECTION 1. SUMMARY

Paragraph
Number

1.1 Background	3
1.2 Objectives	3
1.3 Summary of Procedures	4
1.3.1 Design-to-Objective Procedures	4
1.3.1.1 Identify Current Needs	4
1.3.1.2 Identify the Results of Previous Efforts	4
1.3.1.3 Identify and Limit the Sources of Data Elements	4
1.3.1.4 Develop Techniques to Collect and Maintain Data Elements	5
1.3.2 Software Design Procedures	5
1.3.2.1 GUES Design Procedures	5
1.3.2.2 GDES Design Procedures	5
1.3.3 Project Technical Procedures	5
1.4 Summary of Results	6
1.4.1 Data Base-Directed Automation	6
1.4.1.1 Sources of Data Elements	6
1.4.1.2 Techniques to Collect and Maintain Data Elements	7
1.4.2 Generic Unit Entry System	7
1.4.2.1 GUES Functions	7
1.4.2.2 GUES Inputs	7
1.4.2.3 GUES Outputs	7
1.4.3 Generic Data Entry System	8

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1.4.3.1	GDES Functions	8
1.4.3.2	GDES Inputs	8
1.4.3.3	GDES Outputs	8
1.4.4	Results of Previous Efforts	8
1.4.4.1	In-House BEE0 Software	8
1.4.4.2	Generic Unit Files	9
1.5	Analysis	9
1.6	Conclusions	9
1.7	Recommendations	9
1.7.1	Data Base Recommendations	9
1.7.2	Automated Procedures	9
1.7.3	Supporting Manual Procedures	10
1.7.4	Coordination	10

SECTION 2. DETAILS OF INVESTIGATION

2.1	Identify Current Needs	11
2.2	Identify and Limit the Sources of Data Elements . .	11
2.3	Identify the Results of Previous Efforts	11
2.4	Develop Procedures to Collect and Maintain Data Elements	11
2.5	Develop a Computer Program to Partially Automate the Production of Generic Operator Records	12
2.5.1	Software Design	13
2.5.1.1	Data Base Design	13
2.5.1.2	Internal Data Structures	13
2.6	Detailed Requirements Analysis	13
2.7	Detailed Conclusions	17
2.7.1	Data Source Conclusions	17
2.7.1.1	Supply Bulletin	17

2.7.1.2	VTAADS TOE	17
2.7.1.3	VTAADS VBIOP	17
2.7.1.4	JETDS	17
2.7.2	Automation Effectivness Conclusions	17
2.8	Detailed Recommendations	17
2.8.1	Enhance the System Capability	17
2.8.2	TOE Data Currency and Update	18
2.8.3	Incorporation of Non-TOE Data	18
2.8.4	Report Generation	18

SECTION 3. APPENDIXES

APPENDIX A	- Methodology Investigation Proposal and Directive
APPENDIX B	- Definitions
APPENDIX C	- Software Requirements Specification for the Generic Data Base System
APPENDIX D	- Data Base Design Document for the Generic Unit Entry System
APPENDIX E	- Distribution

TABLE OF FIGURES

Figure 1.	Net Assignment Requirements Network	14
Figure 2.	Doctrine Requirements Network	15
Figure 3.	Function Automation Matrix.	16

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FOREWORD

One of the priority goals of the U.S. Army Test and Evaluation Command (TECOM) Methodology Program is to improve the timeliness and quality of test capabilities. TECOM has tasked the U.S. Army Electronic Proving Ground (USAEPG) in its current modernization plan to support this effort.

This final report documents a USAEPG methodology improvement investigation to identify methods to partially automate assimilation of data from U.S. Army-standard data bases for the development of and integration into a communication equipment operator data base for driving battlefield simulation and modeling.

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SECTION 1. SUMMARY

1.1 BACKGROUND. The electronic battlefield is growing increasingly complex. The rapid advance in communications equipment technology is reflected in the growing requirement for detailed knowledge of the effects of Electromagnetic Compatibility (EMC) and Electromagnetic Vulnerability (EMV) on the ability of engaged forces to communicate on the battlefield.

Modern electronic devices have an inherently high unit cost, and communications systems for battle require large numbers of device units. Direct testing of new systems became prohibitively expensive. TECOM gained economy and flexibility in test programs by adopting an additional test methodology, numerical simulation, to produce data representative of full-scale field tests.

The simulations require a computerized representation of every emitter and receptor on the battlefield. The extensive data base generation needed to support large-scale simulations limited the scope and responsiveness of test programs. Partial automation of the data base generation process was accomplished by separating the data base information requirement into two parts: the relatively small generic unit files and the larger deployment files. The generic unit files were prepared manually and then input to a computer program which automatically generated the deployment files. This program, the Communication-Electronic Operator Positioning System (CEOPS), automated the generation of multiple "snapshots" of the battlefield based on manual changes to the generic unit files. The "snapshots" are called Simulated Tactical Deployments (STDs).

The manually prepared generic unit files identify the types and quantities of personnel, vehicles and equipment comprising each unit. The equipment loaded on each vehicle must also be identified in the data base. Data for this purpose is received at least quarterly from several Army-Standard data bases and must be printed, analyzed, integrated, and manually entered into the generic unit files. These activities are manpower-intensive. It is necessary to automate these activities as much as possible.

1.2 OBJECTIVES. The objective of this investigation is to design procedures for comparing and integrating data files from several Army-Standard Force Modernization and Inventory Data Bases and to develop procedures for automating the Battlefield Electromagnetic Environments Office (BEEO) data preparation and data base maintenance process, using the integrated data files. The integration will include partial automation of the process of identifying and resolving discrepancies and anomalies in the data.

The objectives imply a requirement for a computer system, including data base, hardware and software. Based on a trade

study, the VAX 11/785, VAX/VMS, and the INGRES Data Base Management System were selected. A secondary objective was to document software developed as a result of this investigation.

1.3 SUMMARY OF PROCEDURES. The following procedures were used in order to design automated procedures to achieve the objectives.

1.3.1 Design-to-Objective Procedures. The scope of the investigation was restricted to methods for the preparation of Generic Unit Files for simulation of U.S. Army forces using the Force Modernization Data Base as the source specifying organization and equipment.

The data files from several Army-Standard Force Modernization and Inventory Data Bases were compared and integrated by hand and by computer. The files were examined for the existence of similar data elements which would allow discrepancies and anomalies to be identified and resolved in a partially automated fashion. The files were also examined for common keys which would allow them to be cross-referenced. Procedures for automating the file comparison/integration/maintenance process using these files were considered for automation.

1.3.1.1 Identify Current Needs of Simulated Tactical Deployment Generation Systems. The purpose of this procedure was to develop a standard for the evaluation of the product of this investigation. The effort was principally directed toward the input requirements of the Performance Analysis for Communication-Electronic Systems (PACES) Model run on the Cyber 180-830 of the Electromagnetic Environment Test Facility (EMETF). CEOPS used by the EMETF, Fort Huachuca, Arizona, and the Deployment Generation System (DGS), used by the BEEO, Alexandria, Virginia were examined.

The functions of GUF operator records were identified.

1.3.1.2 Identify the Results of Previous Efforts. The purpose of this procedure was to avoid duplication of work and to assure that existing generic unit files and related files would remain usable. The investigators identified and evaluated in-house efforts of the BEEO. This evaluation would also provide insight into the expected direction of the BEEO modeling and simulation data base effort.

1.3.1.3 Identify and Limit the Sources of Data Elements. The purpose of this procedure was to define the inputs to the computer program product. A review of various Army-standard data bases was conducted. The data available from each, its applicability, and currency was assessed. A specific data selection criterion was established.

1.3.1.4 Develop Techniques to Collect and Maintain Data Elements of Interest to the Data Base Effort. The purpose of this procedure was to define the functions of the computer program. The contents of selected Force Modernization data files were examined. Record selection criteria were formulated and programmed. A data file for extracted records was designed.

1.3.2 Software Design Procedures. A methodology was formulated to identify those functions which were suitable for automation. A Generic Data System was developed consisting of the Generic Unit Entry System (GUES) and the Generic Data Entry System (GDES). The requirements for this software are specified in the appendix, "Software Requirements Specification for the Generic Data Base System."

1.3.2.1 GUES Design Procedures. A program was developed based on the identified requirements, taking advantage of existing data files maintained by the BEEO.

It was required that the human-machine interface provide the Military Analyst with supervisory control over the association of operators, equipment, vehicles and antenna.

1.3.2.1.1 Identify the Functions of Operator Records. The investigators identified those consistent constraints for the building of data base operator records that could be retained in software routines and data tables.

These constraints were incorporated into a computer program to facilitate the association of operators, vehicles (or platforms), and communications equipment.

The program was designed to allow equipment to be further associated with its various components and antennas with a minimum of Military Analyst intervention.

1.3.2.2 GDES Design Procedures. The purpose of GDES was to reduce both the calendar time and the manhour resource requirement in generic unit file preparation process.

An ability to easily manipulate the data, make decisions during the building process, and manually enter data was required.

A catalogue of error cases for manual data entry was prepared to explore those areas where error checking and data validation were appropriate.

Compatibility with CEOPS was established as a requirement.

1.3.3 Project Technical Procedures. Preparatory to final software design decisions a chart was prepared in the form of a matrix. There was a row for each of the systems: DGS, CEOPS

(without GDES), and CEOPS (with GDES). There was a column for each relevant simulation methodology function. After GUES was developed, it was added to the matrix, the result is shown in figure 3, page 16.

1.4 SUMMARY OF RESULTS. The ultimate result of this investigation consisted of the computer programs GUES and GDES. One intermediate result precipitated this ultimate result. The intermediate result consisted of recognition of deficiencies of data base-directed automation schemes.

1.4.1 Data Base-Directed Automation.

1.4.1.1 Sources of Data Elements. It was established that the sources must be currently available, without imposing additional requirements upon agencies responsible for those sources. The following sources were selected.

1.4.1.1.1 Table of Organization and Equipment. The VTAADS data (Force Modernization Data Base) for Tables of Organization and Equipment (TOEs) is also available on a data tape. This data file forms the lowest level of definition required for the construction of a generic military unit and reflects a wide range of actual and notional organizations which may be of interest in a modeling and simulation effort. Extraction of data from this source may be accomplished in a straightforward manner and made available as input to the generic operator building process.

1.4.1.1.2 Supply Bulletin. The Supply Bulletin (SB 700-20) is available from the responsible agency on a data tape which uniquely identifies all items of equipment which appear in a Table of Organization and Equipment. While a vast amount of data is contained in the file, suitable filtering reduces the data to a manageable volume. Minimal manual manipulation of the data is required. A procedure is in effect by the responsible agency that facilitates routine monitoring of the currency of the data provided.

A computer program was written to reduce the supply bulletin data and procedures developed to cross reference it to the code book and TOE files.

1.4.1.1.3 Existing In-House Data Files. Significant effort had been made by the BEE0, both prior and subsequent to the development of the DGS, in the definition of those equipment items, from the SB 700-20, which made up the platforms and equipment items to be represented in the generic operator record. Additionally, look-up tables had been developed defining vehicle, equipment, component, and antenna associations which, while not complete, were a sound basis for task development and represented a large percentage of the generic U.S. force data. The data was

completely preserved, although the format for storage, use, and display of this data was changed.

1.4.1.2 Techniques to Collect and Maintain Data Elements of Interest to the Data Base Effort. In each instance, the data available exceeded the requirement for this specific data base. The record selection program was used to extract the relevant data.

Computer program(s) necessary to read the TOE data and build lists of operator/equipment/vehicle/antenna associations were written. These lists would reflect the use of the unit's assigned equipment.

1.4.2 Generic Unit Entry System. GUES automated several doctrine application functions. Analyst choices were displayed as multiple, independently scrollable data tables (windows). Analyst choice selection was input by keyboard-controlled cursor movement.

1.4.2.1 GUES Functions. The following functions of operator records were identified: association of vehicle, operators, equipment and antennas; compatibility of vehicles, equipment and antennas; tracing equipment items to the doctrine documentation for their issue; tracing personnel to doctrine documentation for issue; listing the components of radio frequency (RF) equipment end items; association of operators with communication nets; coding of identifiers for operators, vehicles, RF equipment and antennas.

These functions are automated in GUES, with the following qualifications. Automation depends on maintenance of configuration files and an antenna/vehicle compatibility file. Association of antennas with equipment is an analyst selection from a list of compatible antennas. Association of operators with nets is not automated.

At the beginning of the user session, association of RF equipment with vehicles is an analyst selection from choices determined by the type and number of issued RF equipment and by the configuration file. After the association is done for a vehicle, the number of choices for the remaining vehicles is reduced.

1.4.2.2 GUES Inputs. The primary input is the tables of vehicles, personnel and RF equipment which was extracted from the VTAADS data base. Additional input is from the equipment and component definition files and from the antenna compatibility file.

1.4.2.3 GUES Outputs. The primary output is the operator records, which are directly compatible with GDES data editing and report generation functions. GDES compatibility in turn provides

CEOPS compatibility, provided that net definitions (net header records) are added to the GUES outputs.

The Ingres data base management system allows update of the configuration file and compatibility file.

Operator records output by GUES do not include codes for communications security (COMSEC) devices.

1.4.3 Generic Data Entry System. GDES reduced both the calendar time and the manhour resource requirement in CEOPS simulations. This was accomplished by moving data checking and data validity verification to an earlier point in the simulation process.

GDES, an intelligent data entry system partially automates data coding and certain other doctrine application functions.

GDES was placed into service and successively used for preparation of several simulation data bases.

1.4.3.1 GDES Functions. GDES automatically prevent some coding errors, detects other errors immediately after the erroneous data is entered, and automatically assures certain data integrity constraints.

1.4.3.2 GDES Inputs. GDES eliminates the necessity for coding forms. Instead, the user enters data interactively.

1.4.3.3 GDES Outputs. The primary GDES outputs are CEOPS-compatible generic unit files and summary reports.

Programmed data entry forms were used to develop the human-machine interface. The result was a menu driven, "fill the blanks" system that performed on-line data validity checking and help throughout the work session. The Military Analysts were led through the data entry process in a logical, easily learned way.

1.4.4 Results of Previous Efforts.

1.4.4.1 In-House BEEQ Software. The listings of the supply bulletin filter showed that it was possible to automatically reduce the supply bulletin data, partially selecting vehicles and RF equipment of interest.

The listing of the equipment inventory program showed that it was feasible to use a supply bulletin extract to automatically select equipment of interest from the VTAADS TOE file.

The listing of the vehicle configuration program showed that it was feasible to list the components of the RF equipment of interest by analyzing defined vehicle configurations. It also

showed that antenna candidates could be retrieved from a vehicle/component/antenna interoperability file.

1.4.4.2 Generic Unit Files. A conservative data base design philosophy assured upward compatibility of the old GUFs. Operator information was left joined to antenna, equipment and net information. The code book was retained.

1.5 ANALYSIS. The candidate Army-Standard Data Bases were compared, in form and content, to the identified STD generation system software requirements. The automated functions available using GUES and GDES were compared to the functions required for the preparation of STDs. The results are shown in the Function Automation Matrix, page 16. The GDES program was placed in full service and its effectiveness was judged by the resulting simulation usage. The GUES program was run against a test case generic unit file which had been prepared by current methods.

1.6 CONCLUSIONS. Automated procedures for extraction of operator records, vehicles, and RF equipment have been developed. These procedures depend on maintenance of an RF equipment identifier table by non-automated inspection of the Supply Bulletin. The Army-Standard Data Bases do not possess the data elements and data values required for automation of most Generic Unit File functions.

1.7 RECOMMENDATIONS. The recommendations fall into four categories: data base, automated procedures, supporting manual procedures, and coordination.

1.7.1 Data Base Recommendations. The VTAADS TOE should be used as the primary data source for automatic data extraction when applicable. For simulations to which VTAADS does not apply, a stand-alone table of vehicles, operators, and RF equipment should be constructed and used in its place.

For successful data base automation, additional supplemental data files should be constructed and maintained. These secondary files should include a normalized table of vehicle configurations, a table showing the component composition of major RF equipment items, a vehicle/antenna compatibility table, and a component/antenna compatibility table. A table of standard avionics sets should be included to supplement VTAADS when VTAADS is used.

1.7.2 Automated Procedures. The programs GUES and GDES should be incorporated into the BEEO Library and used for preparing GUFs. The two programs should be combined so that their automated functions can be used together for substantially complete automation.

1.7.3 Supporting Manual Procedures. Personnel should be assigned to maintain the secondary data files specified in paragraph 1.7.1.

1.7.4 Coordination. The results of the parametric data base investigation should be applied to the equipment composition file.

SECTION 2. DETAILS OF INVESTIGATION

2.1 IDENTIFY CURRENT NEEDS OF SIMULATED TACTICAL DEPLOYMENT GENERATION SYSTEMS. CEOPS, used by the EMETF, and DGS, used by BEE0, was reviewed by document study, user and programmer interview to determine respective data element requirements.

2.2 IDENTIFY AND LIMIT THE SOURCES OF DATA ELEMENTS. A specific criterion was established that the sources must be currently available, without imposing addition requirements upon agencies responsible for those sources.

The initial effort of the investigation was directed toward the data available from the Supply Bulletin (SB 700-20) obtained from Army Material Command (AMC) on magnetic tape. This file contains data on equipment items (including vehicles) authorized for publication as issue equipment in the Table of Organization and Equipment for the various U.S. Army units. A data key exists in the Supply Bulletin (LIN) which is common to the TOE files.

The TOE file (VTAADS) uses the data element LIN in the equipment records. Therefore, it was determined that compiling the appropriate LINS, from the supply bulletin, into a look-up table would facilitate extracting items of interest from the TOE file for the partial automation of the generation of operator records.

Table of Organization and Equipment data, available from TRADOC, is furnished on magnetic tape. These files are very large, and contain information on units in varying stages of development. It was assumed that testing may be necessary for various notional as well as actual units; therefore, no effort was made to filter the data.

VTAADS TOE files are produced and distributed quarterly. The SB 700-20 data is similarly available. Vehicle configuration files were produced in-house by BEE0.

2.3 IDENTIFY THE RESULTS OF PREVIOUS EFFORTS. The in-house BEE0 software was received as program source code, without documentation. Techniques for "reverse engineering" the source code were developed to identify the intended functions of the programs. The software included a supply bulletin filter, a VTAADS data extraction program and a vehicle configuration processor. The identified functions formed the starting point for the design of GUES.

2.4 DEVELOP PROCEDURES TO COLLECT AND MAINTAIN DATA ELEMENTS OF INTEREST TO THE DATA BASE EFFORT. An effort to extract the LINS applicable to vehicles, RF equipment, COMSEC equipment, and antennas was undertaken. The starting point for this effort was provided by in-house developed software from BEE0. The BEE0

software illustrated certain concepts and rules for the selection of those data items which would facilitate the identification of most of the LINS of interest to the operator building process.

It may be noted that many anomalies exist in the assignment of data items, such as National Stock Number; however, the result of the computer filter was largely successful. Even though several hundreds of items were selected by the test, it was a fairly simple matter to further categorize each selected item according to the USAEPG Codebook Methodology. Using the facilities of the computer editor and the INGRES DBMS, the remaining items were easily found and related to the codes currently used (where applicable). Additionally, a number of items were found that can be reasonably expected to be of future interest even though not currently recognized in the present codebook.

Extracting data from the VTAADS TOE files for a given unit or set of units can easily be accomplished in any of several methods. These extractions become the input for the (partially) automated operator building process and are made according to the requirements of the task at hand.

2.5 DEVELOP A COMPUTER PROGRAM TO PARTIALLY AUTOMATE THE PRODUCTION OF GENERIC OPERATOR RECORDS. A software program, GUES, was defined and developed for the following functions:

- o automatic selection of vehicles and electronic RF devices
- o automatic selection of legal vehicle/platform configuration lists
- o automatic equipment composition/decomposition
- o menu selection of interoperable antennas
- o automatic look-up of operator codes

The automatic selection of configurations function allows the user to operate on the vehicles and RF electronic devices of a single paragraph at a time. After the analyst manually selects a configuration from the list, the list of possible configurations is re-computed to take into account the reduction in equipment available for assignment. Thus, the fewer and fewer choices are required as the operation continues.

The menu selection of interoperable antennas function depicts the entire complement of vehicles, with the assigned RF electronic devices and interoperable antennas for the current selection, on a graphic display. The choices on the display are determined by the interoperability file PTAB. Refer to the Data Base Design Document, Appendix D.

The operator code look-up function displays codes from the codebook file and allows the desired code to be either selected using the cursor or directly typed in.

A software program for automatic selection of vehicle/platform configuration to maximize RF activity was defined. However, the feasibility could not be verified in the absence of a suitable configuration file. Therefore, this program was not developed.

2.5.1 Software Design.

2.5.1.1 Data Base Design. The BEE0 configuration file was examined for functional dependencies. It was seen that the component and equipment fields were functionally independent, and that the same configuration definition could be used for various kinds of vehicles. Therefore, the equipment/component relation was extracted and put into a separate data base table EQP_DEF. In addition, the configuration references were separated from the configuration definitions, replacing the configuration file with two files, CONFIG_DEF and CONFIG_REF. The vehicle/component/antenna compatibility file of the EMTF was normalized in a similar fashion. Refer to the Data Base Design Document, Appendix D.

2.5.1.2 Internal Data Structures. Linked list structures were chosen to represent partial GUF records. This structure allows flexible handling of incomplete and variable sized data.

The programming for the function described above was accomplished in the PRUNE module which is coded in PASCAL and uses linked lists. The PRUNE module and the linked list utilities will be documented in "Software Detailed Design Document for Generic Data System."

2.6 DETAILED REQUIREMENTS ANALYSIS. This section analyzes functions of the simulation methodology which have been automated, or may be automated for cost savings.

The battlefield modeling requirements were analyzed by constructing dependency networks. For example, the chart "Net Assignment requirements Network" shows how performance scores depend on preparation of generic unit data, specification of generic and specific unit relationships, and compilation of lists of specific units. Collectively, these functions are referred to as organizational relationship application (ORA). The chart applies to any system which uses generic unit files and performs semi-automatic net assignment. It explains the justification for ORA.

The chart "Doctrine Application Requirements Network" explains the requirements for universal doctrine satisfaction, doctrine research and traceability, doctrine research result preservation and equipment utilization. Doctrine application refers to the incorporation of doctrinal associations between personnel, vehicles, and RF equipment into the battlefield model.

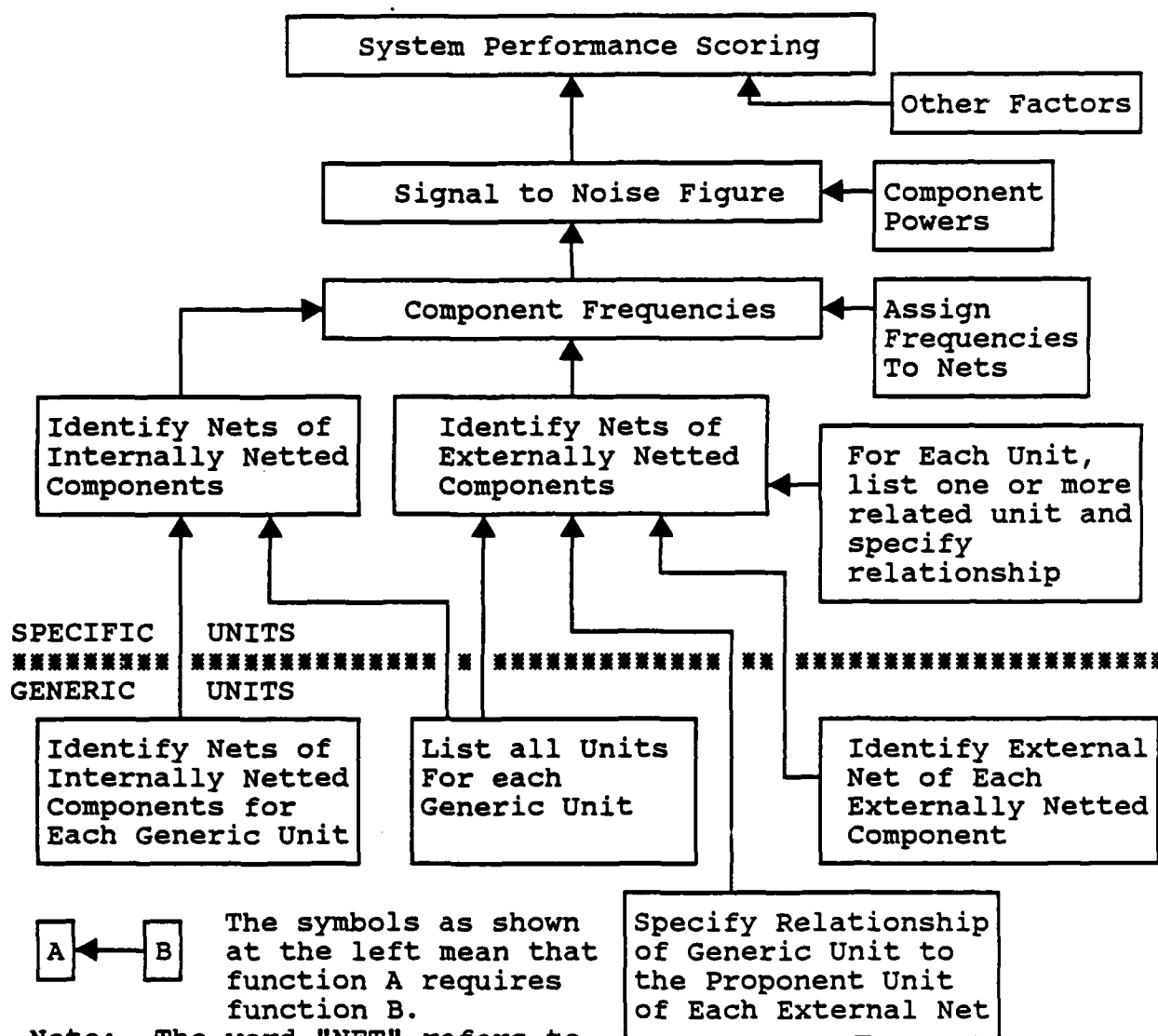


Figure 1. NET ASSIGNMENT REQUIREMENTS NETWORK

Universal doctrine satisfaction means, for example, making sure that every net has a proponent unit and a net control station.

Proper equipment utilization includes basis of issue, interoperability, specification of technical parameters, and listing the equipment components (also called equipment decomposition). Basis of issue means making sure that the issued equipment and personnel, and only the issued equipment and personnel, are put into the model.

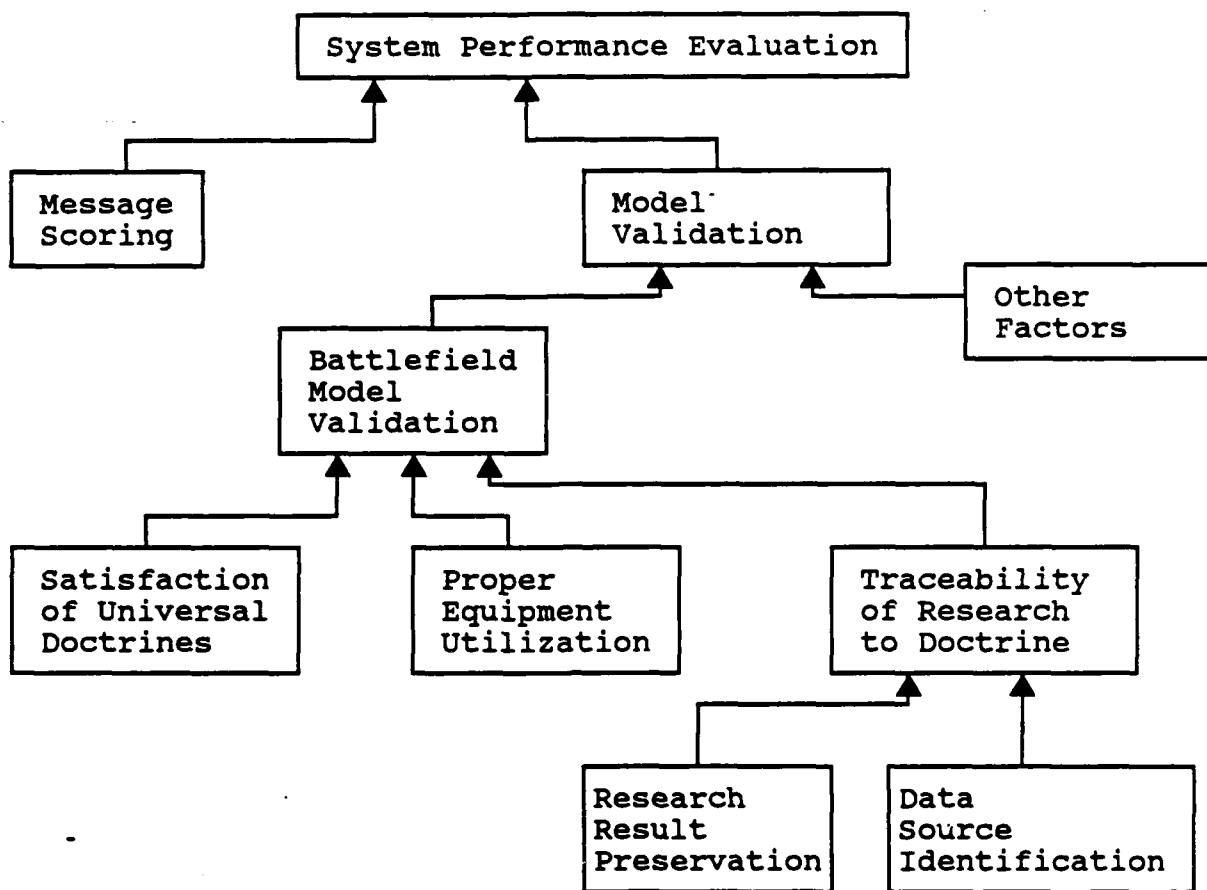


Figure 2. DOCTRINE REQUIREMENTS NETWORK

Interoperability, used here, means that doctrine and device characteristics will allow two pieces of equipment to be used together. For example, two radios which operate in the same frequency band and use the same modulation are interoperable with one another. Similarly, a radio which may be mounted in and powered by a particular vehicle is interoperable with that vehicle. The term "interoperability" is used instead of "compatibility" to avoid confusion with "electromagnetic compatibility."

Technical parameters include transmitter power, frequency band and modulation. For radar systems, they include pulse frequency and width.

Most of the requirements given here include data coding, the assignment of unique identifiers to objects in the battlefield, and the recording of associations between the objects.

Research result preservation means record-keeping in order to prevent duplication of research effort. For example, validated combinations of vehicles, equipment and antennas may be recorded for future reference. Due to the large number of data, research result preservation schemes have had limited application.

The ORA function allows many functions to be automated at the level of specific units (deployment level). ORA includes the integration of inter-unit command/control/support relationships between military units into a numerical, computer readable representation of the battlefield. ORA may also include specification of the geographic positions of RF equipment and operators relative to their unit boundaries.

These derived requirements may be used to compare the four computer programs used to partially automate the preparation of generic unit files, as shown in figure 3, "FUNCTION AUTOMATION MATRIX". The columns of the matrix are the four programs and the rows of the matrix are the functions. The characters placed in the matrix indicate the degree of automation.

	GUES	CEOPS w/GDES	CEOPS only	DGS
Doctrine Satisfaction	M	A	P*	?
Doctrine Research	P	M	M	M
Equipment Basis of Issue	A	M	M	M
Doctrine Traceability	P	M	M	M
Technical Parameters	M	M	M	A
Equipment Composition	A	M	M	M
Data Coding	P	P	M	M
Research Preservation	P	M	M	M
Support Functions	M	P	M	?
Equipment Interoperability —(Platform)—	A	P	M*	M
Equipment Interoperability —(Net)—	M	M*	M*	P

A = Automated P = Partially Automated M = Manual

* - Coding errors are automatically detected after input.

Figure 3. FUNCTION AUTOMATION MATRIX

2.7 DETAILED CONCLUSIONS.

2.7.1 Data Source Conclusions.

2.7.1.1 Supply Bulletin. The Supply Bulletin required filtering and incorporation into a local data base for cross-reference to the code book. This activity is required only once. Future update to the resulting line numbers table will be handled by the normal INGRES data table maintenance procedures. A side effect of the investigation resulted in the production of a version of the Supply Bulletin reduced to generic records that are convenient for research.

2.7.1.2 VTAADS TOE. The TOE files represent an authoritative source of information. While the files are quite large, the structure is easily understood and easy to work with. The TOE files do have a few shortcomings. The two most notable problems are currency and avionics equipment. The matter of currency is due largely to the size of the data base. Data tapes are produced and distributed quarterly, however, a full years worth of data updates are required for a complete data base update. Therefore, data selected may be up to one year old. The avionics equipment on board an aircraft is not reflected in the TOE since this is a part of the aircraft as issued.

2.7.1.3 VTAADS VBOIP. The VBOIP is not available for application as uploadable data. It is possible to make on-line requests for TOEs with the BOIP applied, however, the result is received as hard copy. This is a valuable aid to the Military Analyst making direct data entry adjustments to the data base.

2.7.1.4 JETDS. The Joint Electronic Type Designation System Data Base is valuable for equipment decomposition. The data base information is available on-line as well as the previous microfilm version, however, it is not available for upload. It is the most current equipment source available.

2.7.2 Automation Effectiveness Conclusions. Many of the methodology elements, applicable to generic unit files, have been automated in the programs GUES and GDES. Neither program automates the methodology completely.

2.8 DETAILED RECOMMENDATIONS. This section recommends additional operating procedures, data file construction, and software requirements.

2.8.1 Enhance the System Capability. In GDES, the line number/code book cross reference table should be used for automatic code lookup and/or verification. The equipment decomposition function should be added by using the equipment composition table. Therefore, military analyst time should be allocated for

the validation and maintenance of these tables. Extensions should be planned for non-VTAADS and non-U.S. Army unit data construction.

Equipment should be automatically cross-referenced to a data file supporting the technical parameter identification function.

The current research result preservation methods should be enhanced to reduce the manual research process and assist in the maintenance of supporting data base tables.

2.8.2 TOE Data Currency and Update. Develop an ability to apply the Basis of Issue Plan to the TOE data in order to reflect the most current planning data in the system input. As of this time the VTAADS TOE data is received in various states of completion and in forms of various notional units. It is desirable that the units to be simulated accurately reflect the equipment and the environment to be tested.

2.8.3 Incorporation of Non-TOE Data. The avionics equipment that is integral to aircraft, for example, is not reflected in the TOE. Much of this equipment is of interest to communications modeling and simulation, represents a significant number of communications operators, and must be incorporated in the data base. A facility to reflect this "Standard Avionics Set" is required for a credible system.

2.8.4 Report Generation. The facility made available by the INGRES DBMS suggests that redesign and improvement of the reports generated should be considered. The usability and readability of reports can be improved. Reports now presented to the various users contain a significant amount of coded information. It has been shown that "plain text" reports are more usable, and that the facility now exists to product a more "plain text" report.

APPENDIX A

Methodology Investigation Proposal and Directive

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March 1986

METHODOLOGY INVESTIGATION PROPOSAL

1. TITLE. Automated Analysis and Entry of U.S. Generic-Unit Data
2. CATEGORY. DA Mission Areas supported include electromagnetic Compatibility Program (EMCP) and Electromagnetic Compatibility/Vulnerability analysis. This investigation focuses on improvements in database research, analysis, integration, modeling.
3. INSTALLATION OR FIELD OPERATING ACTIVITY (I/FOA). U.S. Army Electronic Proving Ground (USAEPG), Fort Huachuca, Arizona 85613-7110 and USAEPG/Battlefield Electromagnetic Environments Office (BEEO), Alexandria, Virginia 22333-0001
4. PRINCIPAL INVESTIGATOR. Mr. C. Louis Deibel, BEEO, STEEP-MT-DB, AUTOVON 284-8515
5. STATEMENT OF THE PROBLEM. BEEO presently uses manpower-intensive procedures for data integration and database maintenance. These manual procedures severely limit the scope and responsiveness of the BEEO operations. BEEO does not have the capability to provide routine, timely support to large simulation and testing projects without incurring unacceptably high personnel costs.
6. BACKGROUND. Large-scale battlefield simulation, which are essential for realistic EMC/EMV analysis, consist of thousands of U.S. military units. The BEEO databases which support these simulations must identify the types and quantities of personnel, vehicles, and equipment comprising each unit. The personnel and equipment associated with ("loaded on") each vehicle must also be identified in the database. Data is received at least quarterly from several Army-standard databases and must be printed, analyzed, and integrated by BEEO personnel. New data must then be entered manually to update the BEEO databases. Data analysis, integration, and entry is manpower-intensive. Computer software is needed to reduce the cost and improve the responsiveness of database maintenance operations.
7. GOAL.
 - a. To design procedures for comparing and integrating data files from several Army-Standard Force Modernization and Inventory Databases. The integration will include partial automation of the process of identifying and resolving discrepancies and anomalies in the data.
 - b. To develop procedures for automating the BEEO data preparation and database maintenance process, using the integrated data files.
8. DESCRIPTION OF INVESTIGATION.
 - a. Summary. The formats and contents of several standard databases will be reviewed. Procedures will be developed for comparing and translating data files from these databases and integrating data

Automated Analysis and Entry of U.S. Generic-Unit Data (cont)

with additional information required for battlefield simulation, and EMC/EMV analysis. These procedures will be implemented in data analysis and database maintenance software.

b. Detailed Approach.

(1) The U.S. Army TOE and Force Modernization database (VTAADS/VBOIP) maintained at Fort Leavenworth, KS for HQDA and HQ TRADOC will be compared in format and content with the Army equipment distribution databases (SB 700-20, TAEDP) maintained at Chambersburg, PA for HQDA and HQAMC.

(2) Similar information represented by different databases will be identified. Procedures will be defined for identifying and resolving anomalies and discrepancies between data files.

(3) Procedures will be defined for integrating existing data into a single data file with additional data elements defining doctrinal battlefield tactics and associations between military units, vehicles, personnel, and equipment.

(4) Procedures will be implemented in a set of computer programs and incorporated in the BEE0 library of applications software.

c. Final Product(s).

(1) Documented methodology to create databases for battlefield simulation and analysis by combining, correlating, and supplementing standard data files from Army-standard databases.

(2) Documented computer programs implementing the methodology.

d. Coordination. This investigation will require coordination with other government agencies involved in the development of battlefield simulations as well as activities maintaining or requiring databases which are related to the battlefield electromagnetic environment.

e. Environmental Impact Statement. This investigation will have no adverse affect on the environment.

f. Health Hazard Statement. This investigation will present no health hazard to personnel.

9. JUSTIFICATION.

a. Association with Mission. This MIP directly supports the USAEPG mission to perform development tests of C-E equipment. The capability is required to enable the USAEPG/BEE0 to perform its mission of support to development testing, Army Force Modernization and Army Spectrum Management as defined in AR 5-12 in a timely manner at reasonable cost. It will be used to provide fundamental input data for every project utilizing the EMETF analysis capability and to

Automated Analysis and Entry of U.S. Generic-Unit Data (cont)

provide data for force modernization and doctrinal analysis projects throughout the Army.

b. Association with Methodology/Instrumentation Program. This project supports a priority thrust of the 'ECOM Methodology Program in that it will eliminate a serious existing deficiency in test capabilities.

c. Present Capability, Limitations, Improvement and Impact on Testing if Not Approved. The BEEO has been using manual procedures for analyzing and entering data. These procedures are cumbersome, repetitive, and prone to errors. Data coding sheets and database contents must be continually reviewed for interpretation and transcription errors. The BEEO's productivity and database accuracy is severely limited by this process. Large databases necessary for large-scale (corps-sized or larger) battlefield simulations now require from six months to one year to complete. Analysis projects requiring these large battlefield simulations are utilizing data which may not accurately represent current doctrine and tactics. Reductions in the scope of the simulated battlefield to division-size or less so that the supporting databases will have reasonably current data can result in an incomplete or misleading analysis.

d. Dollar Savings. C3I analysis will be more complete and accurate which will lead directly to better decision-making on C3I programs. It will allow better tradeoff analyses for cost/benefit and force management studies.

e. Workload. BEEO database products will be used for all EIEM analysis efforts, and for test design planning and force Modernization studies. Every electromagnetic-dependent system is required to be analyzed by the EMETF.

Examples of items anticipated for testing utilizing BEEO data include:

	<u>FY87</u>	<u>FY88</u>	<u>FY89</u>
MSE	X	X	X
PJH	X	X	X
GPS	X		
HF IMPROVEMENT	X	X	X

f. Association with Requirements Documents. AR 5-12

10. RESOURCES.

a. Financial.

Dollars (Thousands)

FY87

In-House

Out-of-House

Automated Analysis and Entry of U.S. Generic-Unit Data (cont)

Personnel Compensation	15.0	
Travel	5.0	
Contractual Support		80.0

Subtotals	20.0	80.0
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FY Total 100.0

b. Explanation of Cost Categories.

- (1) Personnel Compensation. For in-house personnel costs.
- (2) Travel. Fort Huachuca, Arizona to Washington, D.C.
- (3) Contractual Support. Major portion of investigation will be performed under contract.

c. Obligation Plan (FY87).

	FO	1	2	3	4	TOTAL
Obligation Rate (Thousands)		25.0	25.0	25.0	25.0	100.0

d. In-House Personnel.

In-House Personnel Requirements by Specialty.

		Manhours		
		FY87		
	Number	Required	Available	Total Required
Systems Analyst	1	450	450	450
Tactician	1	300	300	300
		750	750	750

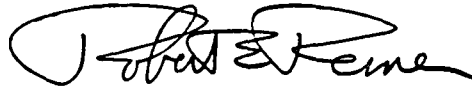
11. INVESTIGATION SCHEDULE.

	FY87
	O N D J F M A M J J A S
In-House	- - R
Contract	A - - - - -

Automated Analysis and Entry of U.S. Generic-Unit Data (cont)

12. ASSOCIATION WITH TOP PROGRAM. None.

FOR THE COMMANDER:

A handwritten signature in dark ink, appearing to read "Robert E. Reiner". The signature is fluid and cursive, with a large initial "R" and "E".

ROBERT E. REINER
Chief, Modernization and
Advanced Concepts Division

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DEPARTMENT OF THE ARMY
HEADQUARTERS, U.S. ARMY TEST AND EVALUATION COMMAND
ABERDEEN PROVING GROUND, MARYLAND 21005-5055

REPLY TO
ATTENTION OF
AMSTE-TC-M

10 SEP 1985

SUBJECT: FY87 RDTE Methodology Improvement Program Directive

Commander
U.S. Army Electronic Proving Ground
ATTN: STEEP-TM-TO
Fort Huachuca, AZ 85613-7110

1. Reference TECOM Regulation 70-12, dated 29 May 1985, subject: TECOM Methodology Investigations.
2. This letter constitutes a directive for the investigations listed in enclosure 1 under the TECOM Methodology Improvement Program 1W665702D625.
3. The MIPs at enclosure 2 are the basis for headquarters approval of the investigations.
4. Special instructions:
 - a. All reporting will be in consonance with paragraph 9 of the reference. The final report will be submitted to this headquarters, ATTN: AMSTE-TC-M, in consonance with Test Event 570/580. Each project shall be completed in FY87 as reflected in the scheduling.
 - b. Recommendations for new TOP's or revisions to existing TOP's will be included as part of the recommendation section of the final report. Final decision on the scope of the TOP effort will be made by this headquarters as part of the report approval process.
 - c. The addressee will determine whether any classified information is involved, and will assure that proper security measures are taken when appropriate. All OPSEC guidance will be strictly followed during this investigation.
 - d. Prior to test execution, the test activity will verify that no safety or potential health hazards to humans participating in testing exist. If safety or health hazards do exist, the test activity will provide a safety/health hazards assessment statement to this headquarters prior to test initiation.

AMSTE-TC-M

1 0 SEP 1986

SUBJECT: FY87 RDTE Methodology Improvement Program Directive

e. Environmental documentation for support tests or special studies is the responsibility of the test activity and will be accomplished prior to initiation of the investigation/study.

f. Upon receipt of this directive, test milestone schedules as established in TRMS II data base will be reviewed in light of other known workload and projected available resources. If rescheduling is necessary and the sponsor nonconcurs, a letter citing particulars, together with recommendations, will be forwarded to Commander, U.S. Army Test and Evaluation Command, ATTN: AMSTE-TC-M, with an information copy to AMSTE-TE-O, no later than 15 calendar days from the date of this letter. Reschedules concurred in by the sponsor can be entered directly along with a properly coded narrative by your installation/test activity.

g. All work shall be performed such that energy consumption and conservation are considered throughout the effort.


h. The HQ, TECOM POC's for individual investigations are listed in enclosure 1, AMSTE-TC-M, AUTOVON 298-2170/3677.

i. FY87 RDTE funds authorized for the investigations are listed on enclosure 1. DARCOM Form 1006 will be forwarded by the TECOM Resource Management Directorate. A cost estimate shall be submitted within 30 days following receipt of this directive.

5. TECOM - Providing Leaders the Decisive Edge.

FOR THE COMMANDER:

2 Encls


GROVER H. SHELTON
Chief, Methodology Improvement
Division
Directorate for Technology

APPENDIX B
Definitions

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DEFINITIONS

AMC	Army Materiel Command
BEEEO	Battlefield Electromagnetic Environments Office
CEOPS	Communication-Electronic Operator Positioning System
COMSEC	Communications Security
DBMS	Data Base Management System
DGS	Deployment Generation System
EMC	Electromagnetic Compatibility
EMETF	Electromagnetic Environmental Test Facility
EMV	Electromagnetic Vulnerability
GDES	Generic Data Entry System
GUES	Generic Unit Entry System
GUF	Generic Unit File
JETDS	Joint Electronic Type Designation System
LIN	Line Item Number
ORA	Organizational Relationship Application
RF	Radio Frequency
STD	Simulated Tactical Deployment
TECOM	U.S. Army Test and Evaluation Command
TRADOC	U.S. Army Training and Doctrine Command
USAEPG	U.S. Army Electronic Proving Ground
VAX	Virtual Address Extension
VBOIP	Vertical, Basis of Issue Plan
VMS	Virtual Memory System
VTAADS	Vertical, The Army Approved Data System

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APPENDIX C

Software Requirements Specification

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SOFTWARE REQUIREMENTS SPECIFICATION
FOR THE
GENERIC DATA BASE SYSTEM

CONTRACT NO. DAEA18-86-C-0001

CDRL SEQUENCE NO. A001

22 September 1987

Prepared For:
US Army Electronic Proving Ground
STEEP-DT-D

Prepared By:
BELL TECHNICAL OPERATIONS
A Subsidiary of Combustion Engineering, Inc.
Building 55350
Fort Huachuca, Arizona

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TABLE OF CONTENTS

	<u>Page</u>
1. SCOPE	1
1.1 Identification	1
1.2 Purpose	1
1.3 Introduction	1
2. APPLICABLE DOCUMENTS	2
2.1 Government Documents	2
2.2 Non-Government Documents	2
3. REQUIREMENTS	3
3.1 Programming Requirements	3
3.1.1 Programming Languages	3
3.1.2 Compiler/Assembler	3
3.1.3 Programming Standards	3
3.2 Design Requirements	4
3.2.1 Sizing and Timing Requirements	4
3.2.2 Design Standards	4
3.2.3 Design Constraints	5
3.3 Interface Requirements	5
3.3.1 Interface Relationship	5
3.3.2 Interface Identification and Documentation	5
3.3.3 Detailed Interface Requirements	5
3.3.3.1 CSCI-to-CSCI Interface Requirements	5
3.3.3.2 CSCI-to-HWCI or Critical Item Re- quirements	6
3.4 Detailed Functional and Performance Requirements	6
3.4.1 Intelligent Data Entry Function	6
3.4.1.1 Validation of Fields Function	6
3.4.1.1.1 Field Validation Inputs	6
3.4.1.1.2 Field Validation Processing	6
3.4.1.1.3 Field Validation Outputs	7
3.4.1.2 Mandatory Fields Function	7
3.4.1.2.1 Mandatory Field Inputs	7
3.4.1.2.2 Mandatory Field Processing	7
3.4.1.2.3 Mandatory Field Outputs	7
3.4.1.3 Field Combination on Record Checking Function	7
3.4.1.3.1 Record Checking Inputs	7
3.4.1.3.2 Record Checking Processing	7
3.4.1.3.3 Record Checking Output	8
3.4.2 Help Function	8
3.4.2.1 Help Function Inputs	8
3.4.2.2 Help Function Processing	8
3.4.2.3 Help Function Outputs	8
3.4.3 Generic Data Base Management Functions	8
3.4.3.1 Report Generation Function	8
3.4.3.1.1 Report Generation Inputs	8
3.4.3.1.2 Report Generation Processing	8
3.4.3.1.3 Report Generation Outputs	9
3.4.3.2 Concurrency Control Function	9

3.4.3.2.1	Concurrency Control Inputs .	9
3.4.3.2.2	Concurrency Control Processing	9
3.4.3.2.3	Concurrency Control Outputs .	9
3.4.3.3	User Access Control Function	9
3.4.3.3.1	User Access Control Inputs .	9
3.4.3.3.2	User Access Control Processing	10
3.4.3.3.3	User Access Control Outputs .	10
3.4.3.4	Transaction Commitment Function . .	10
3.4.3.4.1	Transaction Commitment Inputs	10
3.4.3.4.2	Transaction Commitment Processing	10
3.4.3.4.3	Transaction Commitment Outputs	10
3.4.3.5	Security Control Function (Record Mode)	11
3.4.3.5.1	Security Control Inputs (Record Mode)	11
3.4.3.5.2	Security Control Processing (Record Mode)	11
3.4.3.5.3	Security Control Outputs (Record Mode)	11
3.4.3.6	Security Control (Direct Mode) . . .	11
3.4.3.7	Security Control (Dataset Mode) . .	12
3.4.4	Data Base Integrity Constraint Functions .	12
3.4.4.1	Parent-Child Constraint Function (Record Mode)	12
3.4.4.1.1	Parent-Child Constraint Inputs	12
3.4.4.1.2	Parent-Child Constraint Processing	12
3.4.4.1.3	Parent-Child Constraint Outputs	12
3.4.4.2	Allocation Constraint Function (Record Mode)	12
3.4.4.2.1	Allocation Constraint Function Inputs (Record Mode)	12
3.4.4.2.2	Allocation Constraint Function Processing	13
3.4.4.2.3	Allocation Constraint Function Outputs	13
3.4.4.3	Compatibility Relationship Enforcement (Record Mode)	13
3.4.4.3.1	Compatibility Relationship Inputs (Record Mode)	13
3.4.4.3.2	Compatibility Relationship Processing (Record Mode)	13
3.4.4.3.3	Compatibility Relationship Outputs (Record Mode)	13
3.4.4.4	Compatibility Relationship Enforcement (Dataset Mode)	13
3.4.4.4.1	Compatibility Relationship Enforcement Inputs (Dataset Mode) .	14

3.4.4.4.2	Compatibility Relationship Enforcement Processing (Dataset Mode)	14
3.4.4.4.3	Compatibility Relationship Enforcement Outputs (Dataset Mode)	14
3.4.4.5	Completeness Enforcement Function	14
3.4.4.5.1	Completeness Enforcement Function Inputs	14
3.4.4.5.2	Completeness Enforcement Function Processing	14
3.4.4.5.3	Completeness Enforcement Function Outputs	14
3.4.4.6	Constraint File Maintenance Function	14
3.4.4.6.1	Constraint File Maintenance Function Inputs	15
3.4.4.6.2	Constraint File Maintenance Function Processing	15
3.4.4.6.3	Constraint File Maintenance Outputs	15
3.4.5	Dataset Synthesis Function	15
3.4.5.1	Dataset Synthesis Function Inputs	15
3.4.5.2	Dataset Synthesis Function Processing	15
3.4.5.3	Dataset Synthesis Function Outputs	15
3.5	Adaptation Requirements	15
3.5.1	System Environment	16
3.5.2	System Parameters	16
3.5.3	System Capacities	16
3.6	Quality Factors	16
3.6.1	Correctness Requirements	16
3.6.2	Reliability Requirements	16
3.6.3	Efficiency Requirements	16
3.6.4	Integrity Requirements	17
3.6.5	Usability Requirements	17
3.6.6	Maintainability Requirements	17
3.6.7	Testability Requirements	17
3.6.8	Flexibility Requirements	17
3.6.9	Portability Requirements	17
3.6.10	Reusability Requirements	17
3.6.11	Interoperability Requirements	18
3.6.12	Additional Quality Factor Requirements	18
3.7	CSCI Support	18
3.8	Traceability	18
4.	QUALIFICATION REQUIREMENTS	18
4.1	General Qualification Requirements	18
4.2	Special Qualifications Requirements	18
5.	PREPARATION FOR DELIVERY	18
6.	NOTES	19
6.1	Abbreviations and Acronyms	19

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1. SCOPE

1.1 Identification

This Software Requirements Specification (SRS) establishes the requirements for the Computer Software Configuration Item (CSCI) identified as the Generic Data Base System (GDBS), CSCI C005T004D7, of the Command, Control, Communications and Intelligence (C³I) Data Base Division, US Army Electronic Proving Ground (USAEPG).

1.2 Purpose

This CSCI is required to accomplish timely production of data files which precisely record doctrinal associations between personnel and equipment in generic military units. These data files are required for communication-electronic simulation and other battlefield electromagnetic environment analysis activities. A principal user of these data files is the Performance Analysis of Communication-Electronics Systems (PACES) of the USAEPG.

The data files characterize a stressed electromagnetic environment. The radio frequency (RF) equipment of interest include communications radios, electronic warfare/electronic intelligence devices, radio navigation devices, radar devices, telemetry equipment and remote control/ sensor devices. Non-RF extensions of RF communications nets may be represented by the use of pseudo-radios. (e.g. switchboards, telephones)

RF equipment of interest is related by being in the same net. "Net" usually refers to a radio communication net, but may refer to any time two items share a common frequency or form a communications path.

The major functions of the GDBS are intelligent data entry, help functions, generic unit database management, integrity enforcement, and dataset synthesis. GDBS is a data entry system coupled to a data base management system, with a limited capability for automatic dataset generation.

The GDBS replaces the coding sheets formerly used by military analysts and the accompanying rote data entry function, and it advances the time of error detection to an earlier point in the data processing flow. In addition, it provides a vehicle for executing the partially automated generic unit file building schemes.

1.3 Introduction

This document specifies, for the GDBS, all applicable functional, interface, performance, and qualification requirements, including the requirements for programming design, adaptation and quality factors. Traceability requirements are not included.

2. APPLICABLE DOCUMENTS

The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered superseding requirements.

2.1 Government Documents

DoD-STD-2167 Defense System Software Development

2.2 Non-Government Documents

The following documents may be obtained from the Contracting Officer's Representative of the EMETF, STEEP-DT-S, Fort Huachuca, Arizona 85613-7110:

BTO 86-11-004	Time and Labor Estimate, MIP Generic Unit Entry, Revised 14 November 1986
BTO 87-02-010	CEOPS Data Base Files, Revised 21 July 1987
BTO 86-04-002	Description of the CEOPS Programs, Revised 6 August 1987
BTO 87-02-003	DBDD for the Generic Data Entry System, Revised 6 August 1987
BTO 87-04-008	Software Requirements Specification for the Generic TOE Reports, Revised 30 April 1987

The following documents may be obtained from Digital Equipment Corporation, 110 Spit Brook Road, Nashua, NH 03062-2698:

AA-Y510B-TE	Guide to VAX/VMS System Security
AA-H485D-TE	VAX PASCAL User's Guide
AA-L369B-TE	Programming in VAX PASCAL
AA-D034D-TE	Programming in VAX FORTRAN
AA-D035D-TE	VAX FORTRAN User's Guide
AI-Y503B-TE	Guide to programming on VAX/VMS (FORTRAN Edition)

The following documents may be obtained from Relational Technology, 1080 Marina Village Parkway, Alameda, CA 94501-9891:

INGRES/QUEL REFERENCE MANUAL

INGRES/FORMS: Visual-Forms-Editor User's Guide

INGRES/EQUEL/PASCAL USER'S GUIDE

INGRES/EQUEL/FORTRAN USER'S GUIDE

3. REQUIREMENTS

The requirements for the CSCI are not established by any written documents. The requirements specified herein are derived from the known characteristics of certain prototype computer programs.

3.1 Programming Requirements

3.1.1 Programming Languages

This CSCI will be written in VAX FORTRAN 77 and VAX Pascal with embedded QUEL statements. QUEL, the query language of the INGRES Database Management System, will be used to program all data base access and will also be used to program man/machine interface functions. The INGRES Visual Forms Editor (VIFRED) will be used to develop menus and forms display interactions. Embedded QUEL statements are referred to as "EQUEL" statements.

3.1.2 Compiler/Assembler

Although VAX Macro assembly language is used during the software development, it will not be used for programming. The assembly language source code will be automatically produced by VIFRED. No person will edit or input assembly language source files.

Except as described in the paragraph above, use of assembly language is neither anticipated nor desired.

3.1.3 Programming Standards

The source code shall conform to the design and coding standards set forth in Appendix C of DoD-STD-2167.

Where source code contains embedded QUEL statements, the standard shall apply to the source code input to the EQUEL pre-processor rather than to the text files output by the EQUEL pre-processor.

Data retrieval operations and man/machine interface functions will be programmed by control constructs which simulate the control action of interrupt service routines. In other words, there will be a block of code which is executed once for each record which is returned in a retrieval. Similarly, there will be blocks of code which are executed before a form is displayed. These are executed when the user presses a function key, when the user moves the cursor out of a display field, and after the form is displayed. These constructs are defined in the EQUOL/FORTRAN and EQUOL/Pascal user's guides.

Local variables which are allocated from the stack will be prevented from being used in other units by the rules of the Pascal compiler. This requires that all variables be allocated in the procedure using them, or in a surrounding procedure.

All units of this CSCI, including all main programs, subroutines, functions and procedures, are the responsibility of the C³I Data Base Department of the EMETF.

A formal testing and problem reporting procedure will not be instituted prior to delivery of the CSCI because of the close association between users and developers.

3.2 Design Requirements

The design requirements are stated here in reference to the present configuration and usage of the Digital Equipment Corporation (DEC) VAX-11/785 computer at the Field Engineering Division, Data Systems Branch of the US Army Electronic Proving Ground, Fort Huachuca, Arizona. This is a multiuser system supporting other programs not related to this CSCI.

3.2.1 Sizing and Timing Requirements

The GDBS will support seven concurrent users each requiring less than four megabytes of virtual memory. The timing requirements depend on the mode of operation. There are two modes: record mode and dataset mode. In record mode, this CSCI will use less than 25% of the computers' total Central Processing Unit (CPU) processing time per user, with the user waiting time averaged over the user's entire session to be less than 45 seconds. In dataset mode, the CSCI will use less than 50% of the CPU with the average waiting time required to process one unit less than 90 seconds.

3.2.2 Design Standards

This CSCI will be designed in compliance with the requirements of DoD-STD-2167.

3.2.3 Design Constraints

This CSCI will be designed to run on the DEC VAX-11/785 at the Field Engineering Division, Data Systems Branch of the US Army Electronic Proving Ground, Fort Huachuca, Arizona. Use of mass storage and peripheral devices will be consistent with present configuration of that machine.

The INGRES Data Base Management System and the VAX/Virtual Memory System (VMS) operating system will be used. This implies that the man/machine interface will be implemented using the INGRES VIFRED.

This CSCI must satisfy the following conventions: Every RF item of interest shall be treated as a communications radio carried on a vehicle connected to an antenna and operated by an operator. Every net will be controlled by an operator and equipment item which comprise the Net Control Station (NCS). Pseudo-radios, pseudo-antennas, pseudo-vehicles and pseudo-NCS's will be created whenever these conventions would otherwise be violated.

3.3 Interface Requirements

This paragraph specifies the user interfaces, report output interface, Communications-Electronics Operator Positioning System (CEOPS) compatibility interface, and super-user interface to the CSCI. The data base server interface is managed by the EQUQL preprocessor and the data base server. Therefore, these interfaces, which are transparent to both the CSCI developers and the CSCI users, are not specified here. The character data communication interface of this CSCI to the terminal, with the exception of function key mapping, is managed transparently by the VAX/VMS operating system and is not specified here.

3.3.1 Interface Relationship

The GDBS will have interfaces to the terminals, to report printers, and to the tape drive.

3.3.2 Interface Identification and Documentation

None.

3.3.3 Detailed Interface Requirements

3.3.3.1 CSCI-to-CSCI Interface Requirements

One CSCI with which the GDBS interfaces, CEOPS (an EMETF Cyber 180-830 set of programs), is documented in "CEOPS Data Base Files". The other CSCI, Generic TOE Reports (also run on the EMETF Cyber), is documented in "SRS for the Generic TOE Reports". The data base transactions are described in the "INGRES/QUEL Reference Manual".

Data output for the CEOPS and TOE Report CSCIs of the EMETF Cyber computer will be transferred via magnetic tape in ASCII format, 80 character fixed length records. The record contents and format are specified in "CEOPS Data Base Files".

3.3.3.2 CSCI-to-HWCI or Critical Item Requirements

No interfaces to hardware other than those managed by the VAX/VMS Operating System are anticipated.

3.4 Detailed Functional and Performance Requirements

As stated in paragraph 1.2, the major functions of the GDBS are intelligent data entry, help functions, generic unit database management, integrity enforcement, and dataset synthesis. The CSCI will operate in three modes: record mode, dataset mode, and direct mode. The three modes each use a different subset of the total CSCI functions. Record mode is usually called the Generic Data Entry System (GDES). Dataset mode is usually called the Generic Unit Entry System (GUES). Direct mode can be either INGRES (INGRES subsystems) or GDES (run all users). In direct mode, all CSCI functions defined by the INGRES documentation set, which are applicable to the data base are provided. Only the super-user(s) are given privilege to use the direct mode. (See paragraph 3.4.3.6 for a description of "super-user".)

3.4.1 Intelligent Data Entry Function

These functions include validation of fields, inheritance of previous values for fields, mandatory fields, and field combination on record checking. This function will be active when GDBS is operating in record mode (GDES) and a record is modified or a new record is added. Intelligent data entry function will be applied by making a data entry field on a visual form for every applicable field of the data records created by the GDBS.

3.4.1.1 Validation of Fields Function

The validation of fields function checks values entered against legal value ranges and legal value lists.

3.4.1.1.1 Field Validation Inputs

The user input at the keyboard will be compared with legal value lists in the codebook files, which are defined in the "DBDD for the Generic Data Entry System". Legal value constraint formulas will be taken from the forms produced by the INGRES subsystem VIFRED.

3.4.1.1.2 Field Validation Processing

The data entered will be checked for range and against the legal value list.

3.4.1.1.3 Field Validation Outputs

Valid data will be displayed on the screen as it is accepted. Invalid data will cause plain English error messages and/or a beep (bell) at the terminal.

3.4.1.2 Mandatory Fields Function

Mandatory fields are fields which must have a value entered before the user can append a new record to the data base.

3.4.1.2.1 Mandatory Field Inputs

Mandatory fields will be identified by the attribute mandatory on the data entry visual form attribute edit form. The user will usually acknowledge an error message with a carriage return.

3.4.1.2.2 Mandatory Field Processing

Whenever a visual form is displayed and a mandatory field is absent, the session will be suspended until the user acknowledges the error and/or corrects it.

3.4.1.2.3 Mandatory Field Outputs

If the field is blank or in error then an error message will be output to the screen. Otherwise, the field entry is accepted.

3.4.1.3 Field Combination on Record Checking Function

This function will check for legal combinations of field values on each record before the record is appended to the data base.

3.4.1.3.1 Record Checking Inputs

The record entered by the user will be checked against the records of the legal combination reference file.

3.4.1.3.2 Record Checking Processing

A search will be performed for a record in the legal combination reference file. If the search fails, an error message will be output and the new record will be rejected.

3.4.1.3.3 Record Checking Output

Output will consist of an error message.

3.4.2 Help Function

The help function provides scrollable text information to the user, on demand, tailored to the user's current step in the data entry operation. The help functions are active in the record (GDES) mode.

3.4.2.1 Help Function Inputs

The user invokes the help function via a single function key. The help text comes from a text file which may be edited by the super-user.

3.4.2.2 Help Function Processing

The text may be scrolled a line or page at a time on the terminal until the user presses 'END'. Then the screen will be restored to its previous display.

3.4.2.3 Help Function Outputs

The help text is displayed on the screen.

3.4.3 Generic Data Base Management Functions

These functions include report generation, concurrency control, user access control, record validity and record integrity checking.

3.4.3.1 Report Generation Function

This function will provide generic unit summary reports.

3.4.3.1.1 Report Generation Inputs

The user will produce reports on demand by selecting the PRINT function from the menu while the table of Standard Requirements Code (SRC) numbers are displayed. The SRC number marked by the cursor location will identify the generic unit to be printed. All records for that unit will be reported. After the first processing phase, the user will enter a number for the number of copies of the report to be printed.

3.4.3.1.2 Report Generation Processing

For each net, the data pertaining to that net is collected and associated with the data pertaining to RF equipment of interest in that net. The data is sorted by the Operator ID and Operator Number of the operators in that net. The report is formatted and sent to the printer one or more times.

3.4.3.1.3 Report Generation Outputs

The report output will consist of line printer pages containing the net data and equipment data, broken down by net, with one line of data for each component of each item of equipment in the net. The data line will include data about the vehicle and operator associated with that item of equipment. The report generation function will be available when the CSCI is operating in record (GDES) mode.

3.4.3.2 Concurrency Control Function

The concurrency control function sequences and synchronizes user access to the data base.

3.4.3.2.1 Concurrency Control Inputs

None.

3.4.3.2.2 Concurrency Control Processing

Concurrency control will take place when two users are deadlocked according to the logical record blocking internal to the data base. The action will cause the second user to wait for the completion of the first user's update.

3.4.3.2.3 Concurrency Control Outputs

None.

3.4.3.3 User Access Control Function

The user access control function will discriminate between user and super-user, will challenge and identify all users, and will protect each user's data from any access by other users. This is a record mode (GDES) function.

3.4.3.3.1 User Access Control Inputs

Each user will enter their user ID and password at log-in time. The super-user will have built and maintained a list of user ID's and user/super-user flags prior to the particular user's log-in time. The supervisor may also enter any user's ID with an SRC number.

3.4.3.3.2 User Access Control Processing

The CSCI will automatically maintain an ownership relation between users and generic units, and will allow the super-user to transfer ownership.

User access control processing will occur at startup time immediately after log-in, at the time the first SRC Header Record associated with a particular generic unit is appended to the data base, and anytime the records of a generic unit are transferred to another user. The actions will be as follows: At startup time the generic unit(s) whose most recent access was done by the user will be selected. The user will be granted access to these units. At the time an SRC Header Record is appended to the data base, the user's ID will be recorded and associated with that unit. At transfer time, the user ID entered by the super-user will replace the user ID associated with the unit. A user will be required to exit and re-enter the record mode (GDES) to gain access to units reassigned after entry.

3.4.3.3.3 User Access Control Outputs

The user ID of the owner of each generic unit will be displayed to the super-user at startup time.

3.4.3.4 Transaction Commitment Function

The transaction commitment function will manage situations where the data entered for each field of a record is valid, but the combination of values in the record is invalid. It will prevent the invalid record from being appended to the data base.

3.4.3.4.1 Transaction Commitment Inputs

A table of valid combinations will be included in the data base and accessible only to the super-user in the direct mode.

3.4.3.4.2 Transaction Commitment Processing

This function maintains a record in a state of suspense until the record is validated. It will discard the record if it is invalid. Otherwise, the record is appended to the data base.

3.4.3.4.3 Transaction Commitment Outputs

When the user attempts to add an invalid record to the data base an error message will be displayed. The data fields will not be cleared, and the user will be given an opportunity to correct the record.

3.4.3.5 Security Control Function (Record Mode)

This function supports the labeling and access restriction of secret data. Records in the data files will possess unique security level attributes. However, those records in the net header, operator, and vehicle tables will possess a single security level for all records pertaining to a single generic unit. (See below and also see paragraph 3.6.4.)

3.4.3.5.1 Security Control Inputs (Record Mode)

The maximum security level is obtained from the existing generic units owned by the user.

The security level of a generic unit will be input by the Military Analyst at the time the SRC Header Record data is entered. The security level of all data associated with that generic unit, as indicated by the SRC Number, will be inherited from the security level of the generic unit. There will be three security levels: 0 = unclassified; 1 = confidential; 2 = secret. The system will not allow downgrading the classification of a unit if there are codes of higher classification contained in any of the records.

3.4.3.5.2 Security Control Processing (Record Mode)

The highest security level of all generic units belonging to the Military Analyst will be selected as the maximum level.

Certain functions of the CSCI cause data to be extracted from the codebook tables and joined to data in the operator and vehicle tables. The results will be output to reports and displayed to the military analyst at his workstation. The security control function will restrict retrieval of classified codebook nomenclature by not processing or displaying nomenclature data whose classification is higher than the classification of the current generic unit.

3.4.3.5.3 Security Control Outputs (Record Mode)

The highest security level will be displayed to the Military Analyst when the SRC Header Records (generic units) are displayed. At other times, the security level of the current generic unit will be displayed. This level is also included on printed reports.

3.4.3.6 Security Control (Direct Mode)

Only the Data Base Administrator/super-user will have access to the direct mode. The super-user has privileges above the customary users. The super-user functions within the group in a fashion similar to the System Manager's function within the total system. There are no explicit security control inputs, processes, or outputs in direct mode.

3.4.3.7 Security Control (Dataset Mode)

In dataset mode (GUES), classified data will not be accessed. All data added will be given a security code of "0" (unclassified). There are no explicit security control inputs, processes, or outputs in the dataset mode.

3.4.4 Data Base Integrity Constraint Functions

Integrity constraint functions will be active in both the record (GDES) and dataset (GUES) modes. These functions will assure the correct relationships between records so that the data base information will be consistent and meaningful. Integrity constraints include parent-child relationship enforcement, allocation relationship enforcement, compatibility relationship enforcement, and completeness enforcement. These functions will be supported by constraint file maintenance, which is done in direct mode. The other integrity functions are not available in direct mode. The integrity (sub) functions work differently in the different modes, so they will be documented here as distinct functions.

3.4.4.1 Parent-Child Constraint Function (Record Mode)

The GDES user will be presented with the option of creating a net only after he has selected or created a generic unit. Likewise, he will have the option of creating an operator only after he has created a net.

3.4.4.1.1 Parent-Child Constraint Inputs

None. Constraint is accomplished by forcing the sequence of events as described in paragraph 3.4.4.1.

3.4.4.1.2 Parent-Child Constraint Processing

None.

3.4.4.1.3 Parent-Child Constraint Outputs

None.

3.4.4.2 Allocation Constraint Function (Record Mode)

The GDES user will be prevented from putting the same operator on two vehicles, or declaring two net control stations for the same net. Operators placed on the same vehicle as one another will remain on the same vehicle even when vehicle data is modified.

3.4.4.2.1 Allocation Constraint Function Inputs (Record Mode)

The entry of an Operator ID and Operator Number will be an input for vehicle allocation. The vehicle code and sequence number are also inputs. The NCS code entry will be an input for net control station allocation. These data entries correspond to key fields in the data base tables.

3.4.4.2.2 Allocation Constraint Function Processing

When the operator ID and number are entered, the CSCI will search for associated vehicle information. If found, the operator record will receive that vehicle information. When vehicle data is modified, the CSCI searches for and modifies data for all operators on that vehicle. When an NCS code is entered, if the NCS code identifies that operator with the net control station, then the CSCI will search for a previously declared NCS operator.

3.4.4.2.3 Allocation Constraint Function Outputs

In the event of a re-declared net control station, an error message will be output to the terminal. Vehicle data modifications will act on the vehicle data table and will cause an advisory message to be displayed.

3.4.4.3 Compatibility Relationship Enforcement (Record Mode)

The CSCI will reject incompatible combinations of RF equipment, component, antenna, and vehicle.

3.4.4.3.1 Compatibility Relationship Inputs (Record Mode)

The major equipment code, component code, antenna code, and vehicle code fields of the data entry form will be assembled into a reference record.

3.4.4.3.2 Compatibility Relationship Processing (Record Mode)

The reference record (see paragraph 3.4.4.3.1) is searched for in the compatibility table.

3.4.4.3.3 Compatibility Relationship Outputs (Record Mode)

The status of the reference record search is passed to the transaction commitment function. (See paragraph 3.4.3.4.2.)

3.4.4.4 Compatibility Relationship Enforcement (Dataset Mode)

The GUES user will supervise the selection of compatible vehicle/major equipment and compatible component/antenna combinations from two compatibility tables. The correct major equipment/component combination will be obtained from an equipment definition table.

3.4.4.4.1 Compatibility Relationship Enforcement Inputs (Dataset Mode)

The selection of vehicle/equipment will come from the application of a rule, which may imply user input. The selection of a compatible antenna will come from user input.

3.4.4.4.2 Compatibility Relationship Enforcement Processing (Dataset Mode)

None, except for carrying out user selection and retrieving definitions.

3.4.4.4.3 Compatibility Relationship Enforcement Outputs (Dataset Mode)

The joined vehicle, equipment, component and antenna will be output to the table of operator records.

3.4.4.5 Completeness Enforcement Function

The completeness enforcement function will assure that at least one record will be created for every component part of an RF item of interest, and that the correct emitter/receiver characteristic code will be attributed to that component. This function will be available in dataset (GUES) mode only.

3.4.4.5.1 Completeness Enforcement Function Inputs

The completeness enforcement will be driven by tables of equipment and component definitions. These tables are identified as EQP_DEF and COMP_DEF in the "DBDD for the Generic Data Entry System Document".

3.4.4.5.2 Completeness Enforcement Function Processing

Using the equipment code, the tables EQP_DEF and COMP_DEF are searched to find the applicable data elements required to complete the component and emitter code fields.

3.4.4.5.3 Completeness Enforcement Function Outputs

The component code and emitter code fields will be outputs. (See also paragraph 3.4.4.4.3.)

3.4.4.6 Constraint File Maintenance Function

The super-user will be able to append to, update, retrieve from, and generate reports from the constraint (compatibility) file. This function will be active only when the CSCI is in direct mode.

3.4.4.6.1 Constraint File Maintenance Function Inputs

The inputs will be standard QUEL commands and INGRES subsystem commands.

3.4.4.6.2 Constraint File Maintenance Function Processing

The processes will be standard QUEL command processes and INGRES subsystem processes.

3.4.4.6.3 Constraint File Maintenance Outputs

The outputs shall consist of standard INGRES QUEL retrieval, and a printed report of the constraint file.

3.4.5 Dataset Synthesis Function

The dataset synthesis function searches for the combinations of RF equipment items of interest which produce the most stressed electromagnetic environment, subject to the constraints on which equipment may be placed on which vehicles and which equipment may be mounted on the ground or carried by an operator. This function will only be active in dataset (GUES) mode.

3.4.5.1 Dataset Synthesis Function Inputs

The dataset-synthesis function will read the table of vehicle configuration constraints, the CONFIG_REF and CONFIG_DEF files. It will also access the tables of organization and equipment in the Vertical, The Army Approved Data System (VTAADS) data files and respond to user inputs. The dataset synthesis function will accomplish its end under supervisory control of the Military Analyst. Due to the synthetic nature of this function, it may access any data in the CSCI.

3.4.5.2 Dataset Synthesis Function Processing

This function will operate as a production system. This means that there will be a processing state, a set of production rules and a termination condition. Repeatedly, the function will examine the state, select applicable production rules, determine the highest priority rule (with user input), and apply that rule to update the state. Processing will terminate when the user either uses all the RF equipment or quits).

3.4.5.3 Dataset Synthesis Function Outputs

This function outputs partial operator records.

3.5 Adaptation Requirements

The CSCI adaptation data includes user terminal type, code-book size and data base table file index structures.

3.5.1 System Environment

The system environment includes terminal types. The terminal types will be accommodated by the use of Forms Runtime System Mapping Files which are described in the INGRES documentation.

Terminal type accommodation data will be used by the man/machine user interfaces of all functions of the CSCI.

3.5.2 System Parameters

The system parameters include codebook size limit and data base optimization statistics. The codebook size limit is set by a FORTRAN parameter statement, is used by the field validation function and applies to the operator code field of the operator records only.

The data base optimization statistics data will be collected when the data base administrator gives the optimize command, and are subsequently applied whenever data base retrieval occurs from the data base of this CSCI. All functions which retrieve from the data base are effected.

3.5.3 System Capacities

System capacity is limited by the system hardware. The maximum numbers of nets per generic unit and operators per net affects the parent-child integrity enforcement function.

3.6 Quality Factors

3.6.1 Correctness Requirements

The data base which is loaded and maintained by the CSCI GDBS shall consistently and faithfully represent the organizational characteristics of the generic units as defined by the Military Analyst. It shall characterize maximal use of RF equipment according to analyst input (dataset mode).

3.6.2 Reliability Requirements

The CSCI reliability shall be considered to be acceptable if it is sufficient to allow the generic unit files for 200 generic units to be created in record mode without failure due to improperly functioning software. For dataset mode, the requirement will be 75 generic units.

3.6.3 Efficiency Requirements

The CSCI shall be designed to minimize data storage and execution time.

3.6.4 Integrity Requirements

No one will be able to use the CSCI without a valid password. This service will be provided by the operating system environment and will not be part of the CSCI. The operating system will provide user names also. The CSCI will maintain a table of authorized users and authorized privileged users (super-users). Unauthorized persons will be rejected. Access to a generic unit will be allowed only to the user who currently owns the unit and to privileged users.

3.6.5 Usability Requirements

A Military Analyst with no computer background will be able to use this CSCI after four supervised lessons. This applies to usage in records (GDES) mode. In dataset mode (GUES), familiarity with vehicle configurations will also be required. To use the CSCI in direct (INGRES) mode, fundamental knowledge of QUEL, the query language, and relational data base operations and structures shall also be required.

Interpretation of output reports shall require no additional effort. The reports will be similar to the format of existing reports produced by other CSCI's.

3.6.6 Maintainability Requirements

The CSCI shall be designed in a modular structure with each module performing a single well-defined function. The maintenance effort shall consist of identifying the module associated with the function in question and locating the error within the module.

3.6.7 Testability Requirements

Not specified.

3.6.8 Flexibility Requirements

None.

3.6.9 Portability Requirements

The maximum effort required to transfer the implemented CSCI to a DEC MicroVAX will be one man year. The ability to port this system to any other has not been estimated.

3.6.10 Reusability Requirements

None.

3.6.11 Interoperability Requirements

The output data shall be compatible with the CEOPS CSCI of the PACES system.

3.6.12 Additional Quality Factor Requirements

None.

3.7 CSCI Support

To be determined. Includes facility security.

3.8 Traceability

This CSCI is traceable to TRMS PROJECT NO: 7-CO-R87-EPO-007, Methodology Investigation Proposal - Generic Unit Entry.

4. QUALIFICATION REQUIREMENTS

4.1 General Qualification Requirements

General qualifications shall be accomplished by demonstration and inspection of data on the screens and in printed reports.

4.2 Special Qualifications Requirements

None.

5. PREPARATION FOR DELIVERY

The name and number of the CSCI to be delivered are the GDBS CSCI and CSCI C005T004D7 respectively. The media for delivery for the GDBS CSCI will consist of executable object files for the GUES and GDES resident on the DEC VAX 11/785.

6. NOTES

A glossary of terms used in this specification are as follows:

6.1 Abbreviations and Acronyms

BTO	Bell Technical Operations
C ³ I	Command, Control, Communications and Intelligence
CEOPS	Communications-Electronics Operator Positioning System
CM	Configuration Management
CPU	Central Processing Unit
CRDL	Contract Requirements Data List
CSCI	Computer Software Configuration Item
DBDD	Data Base Design Document
DEC	Digital Equipment Corporation
DoD	Department of Defense
EMETF	Electromagnetic Environmental Test Facility
GDB	Generic Data Base
GDBS	Generic Data Base System
GDES	Generic Data Entry System
GUES	Generic User Entry System
HWCI	Hardware Configuration Item
MIP	Methodology Investigation Proposal
NCS	Net Control Station
PACES	Performance Analysis for Communication-Electronic Systems
QA	Quality Assurance
RF	Radio Frequency
SRC	Standard Requirements Code
SRS	System Requirement Specification

STD	Standard, also Standard Tactical Deployment
TOE	Table of Organization and Equipment
USAEPG	U.S. Army Electronic Proving Ground
VMS	Virtual Memory System
VTAADS	VERTICAL, The Army Approved Data System

APPENDIX D
Data Base Design Document

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DATA BASE DESIGN DOCUMENT
FOR THE
GENERIC DATA ENTRY SYSTEM
CONTRACT NO. DAEA18-86-C-0001
CDRL SEQUENCE NO. None
6 FEBRUARY 1987

Prepared for:
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Revised August 1987

DBDD-C005T004D7

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TABLE OF CONTENTS

DATA BASE DESIGN DOCUMENT FOR THE GENERIC DATA ENTRY SYSTEM

1.	SCOPE	1
1.1	Identification	1
1.2	Purpose	1
1.3	Introduction	1
2.	APPLICABLE DOCUMENTS	1
2.1	Government Documents	1
2.2	Non-Government Documents	1
3.	REQUIREMENTS	2
3.1	Data Base Management System Overview	2
3.2	Data Base Structure	2
3.2.1	Data Base Structure Description	2
3.2.2	Data Base File Interrelationships	5
3.3	Data Base File Design	8
3.3.1	SrcHeader File	8
3.3.2	IntNetHeader File	11
3.3.3	ExtNetHeader File	15
3.3.4	AltNetHeader File	16
3.3.5	GufOperator File	16
3.3.6	Vehicle File	19
3.3.7	MfdcOperator File	19
3.3.8	MfdcMainOper File	20
3.3.9	MfdcRelOper File	23
3.3.10	SpecOpr File	23
3.3.11	CodeGroup File	24
3.3.12	Nomenclature File	25
3.3.13	Description File	26
3.3.14	LineNumbs File	26
3.3.15	Ptab File	27
3.3.16	Config ref File	27
3.3.17	Config def File	27
3.3.18	Eqp def File	27
3.3.19	Comp def File	28
3.3.20	Eq master File	28
3.3.21	Paragraph File	28
3.3.22	Personnel File	31
3.3.23	Equipment File	31
3.3.24	Radios File	31
3.3.25	Vehicle File	32
3.4	Data Base References	32
6.	NOTES	33
6.1	Abbreviations and Acronyms	33

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Security Classification Code	10
2. Category of Force Element Establishing the Net	12
3. Branch or Category of Net	12
4. Echelon Establishing the Net Type	13
5. Frequency Range Bands for Net	14
6. Primary Purpose of the Net	14
7. Functional Coding for Nets	15
8. Emitter/Receptor/Target/Sensor Code	18
9. Unit Posture Codes	21
10. Unit Activity Codes	22
11. Code Group Table	25

LIST OF ILLUSTRATIONS

<u>Figure</u>	
1 Relationship of Key Field in SRC Data Base Tables	3
2 Relationship of Key Fields in Codebook Tables	4
3 Present Scheme for VTAADS Record Processing	9
4 VTAADS Tape Format	30

DATA BASE DESIGN DOCUMENT FOR THE
GENERIC DATA ENTRY SYSTEM

1. SCOPE

1.1 Identification. This Data Base Design Document (DBDD) describes the detailed design of the data base identified as the Generic Data Base (GDB) for the Computer Software Configuration Item (CSCI) identified as the Generic Unit Entry System (GUES) of the Generic Data Entry System (GDES).

1.2 Purpose. The purpose of the GDES is to partially automate the task of the military analyst with an integrated approach to the preparation and management of generic unit files used in creating a simulated tactical deployment. The integrated data base will be compatible with the Communications-Electronics Operator Positioning System (CEOPS) and will support organizational tables of units, nets, operators, vehicles, and equipment that are deployment-independent.

1.3 Introduction. This DBDD shall describe in detail the GDB structure, description, interrelationships, and design.

2. APPLICABLE DOCUMENTS

2.1 Government Documents. The following documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the documents referenced herein, and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

DOD-STD-2167	Defense System Software Development, 4 June 1987
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USAEPPG	Codebook Methodology for Communication Electronic Data Base, September 1986
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2.2 Non-Government Documents

BTO 87-02-010	Description of the Communications-Electronics Operator Positioning System (CEOPS) Data Base Files, revised July 1987
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	INGRES Reference Manual, Relational Technology, Inc., 1983
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3. REQUIREMENTS

3.1 Data Base Management System Overview. INGRES is a relational data base management system developed by Relational Technology, Inc, (RTI). QUEL, the INGRES query language, which allows the user to retrieve, manage, and maintain data in an existing INGRES data base. QUEL statements are either entered directly through the INGRES terminal or embedded within programs written in high-level languages via EQUDEL (Embedded QUEL).

In INGRES every file uses exactly one record format. A file is a table having rows and columns.

3.2 Data Base Structure

3.2.1 Data Base Structure Description

3.2.1.1 SRC Data Base Tables. Relationships of the key fields in the Standards Requirements Code (SRC) data base tables are shown in figure 1. The SRC number field is included as a key field in all SRC data base tables.

Information about particular kinds of devices, operating modes, personnel functions, and security classifications independent of SRC number is represented in coded fields (para 3.2.1.3).

3.2.1.2 VTAADS Data Base Tables. The GBD contains data extracted from VERTICAL, the Army Authorized Document System (VTAADS). VTAADS data base tables--eq_master, paragraph, equipment, radios, and vehicles--contain information about the quantity of equipment and personnel authorized for and issued to generic military units. VTAADS data are less specific than similar data in SRC data base tables because the particular assignments of personnel and equipment to vehicles is not specified in the VTAADS data base tables. Also, the coded fields representing types of devices and personnel functions are not present in the VTAADS data base tables (paras 3.2.1.1 and 3.2.1.3). The security classifications are coded differently than in the Codebook and SRC data base tables.

The TOE number field is included as a key field in all of the VTAADS data base tables.

3.2.1.3 Codebook Data Base Tables. Generic devices, operating modes, personnel functions, and security classifications are represented by coded fields in the SRC and VTAADS data base tables. In order to allow the coded fields to be decoded, more complete information about generic devices, operating modes, personnel functions, and security classifications is contained in the codebook data base tables. The codebook data base tables, which include PTAB, linenumbs, nomenclature, description, config_def, config_ref, eqp_def, and comp_def, are keyed

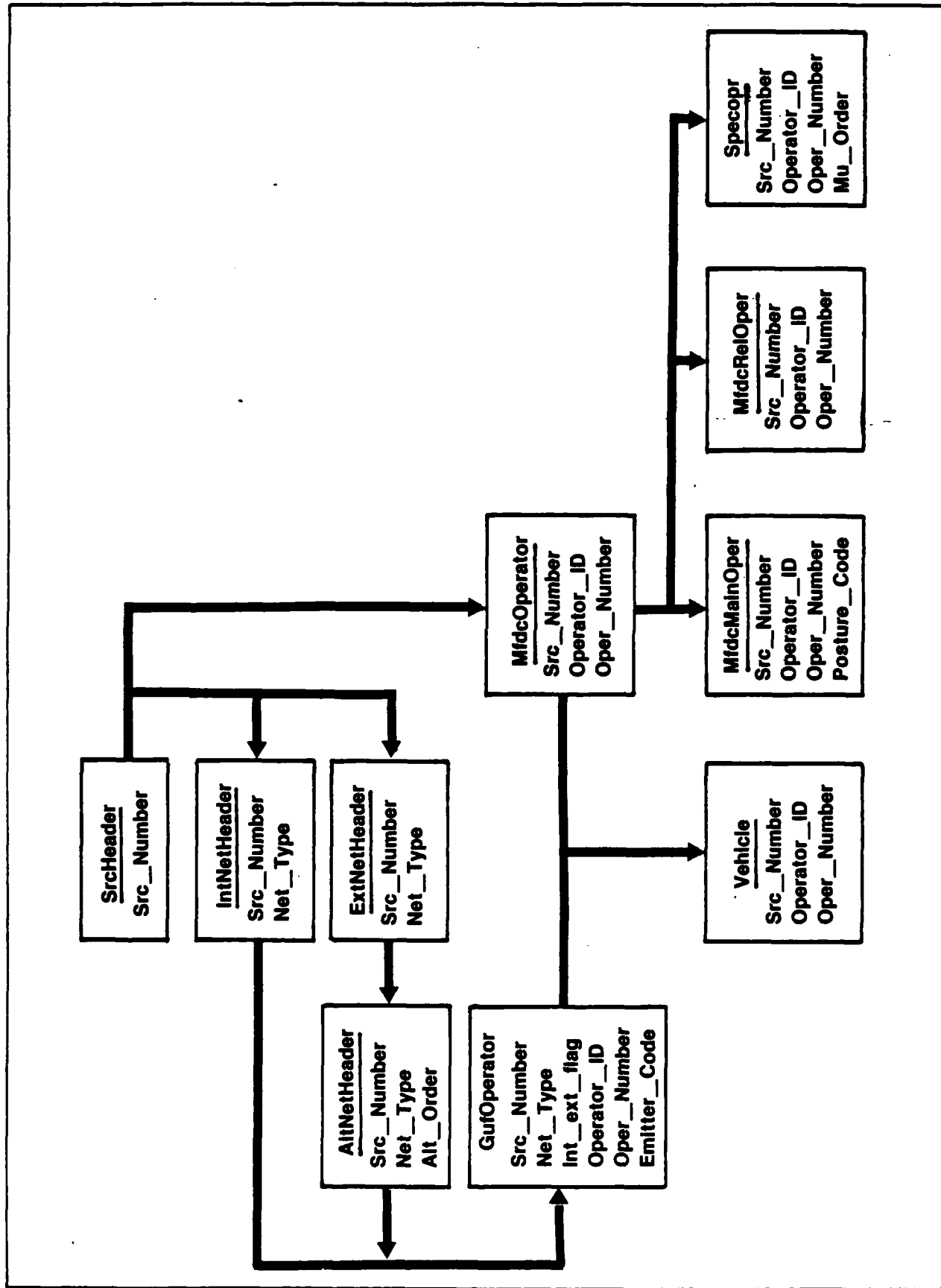


Figure 1. Relationships of Key Fields in SRC Data Base Tables

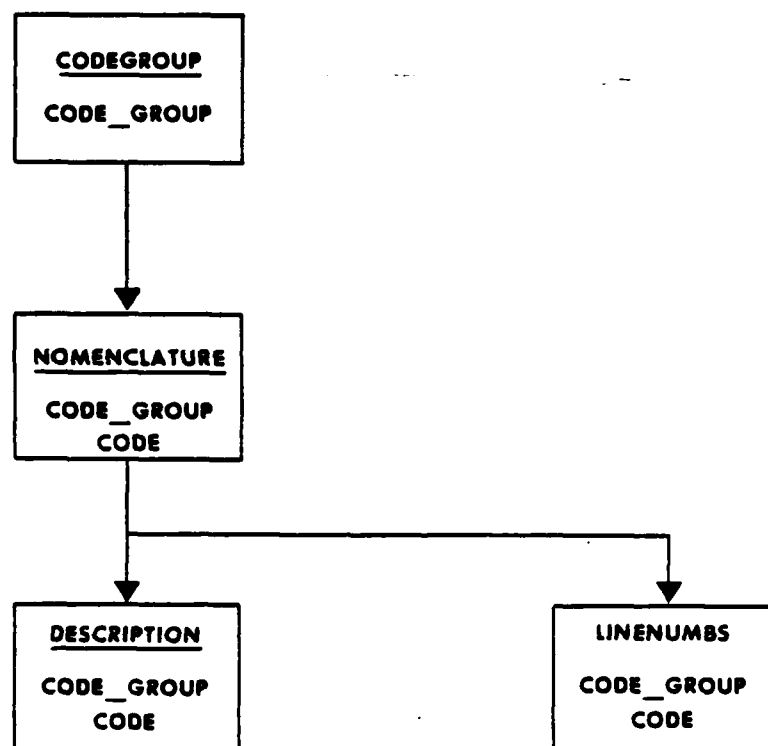


Figure 2. Relationship of Key Fields in Codebook Tables

according to figure 2, which shows the relationships of the key fields.

3.2.2 Data Base File Interrelationships

3.2.2.1 SrcHeader File. There is a record in this file for each unique src_number. Any other file with an src_number field defined can point to that same src_number field in this file and retrieve the secur_class, src_name, deploy_key, and user_id fields from the indicated record.

3.2.2.2 IntNetHeader File. Files with have src_number and net_type fields can point to the these fields in their file and obtain the net_name and other internal net information for that src's net. The src_number can be used as a pointer into the srcheader file to obtain the src information for the same record.

3.2.2.3 ExtNetHeader File. The src_number and net_type fields in this file may be used as pointers into the altnetheader file to retrieve the alternate net types and src_number fields. The src_number or ext_src_num can be used as a pointer into the intnetheader file to obtain the internal net information for the most common net entered.

3.2.2.4 AltNetHeader File. The alt_src_num and alt_net_type fields may be used as pointers into the intnetheader file's src_number and net_type fields to obtain internal net header information. The src_number and alt_src_num fields must point to the src_number field in the srcheader file to obtain the complete information for that SRC.

3.2.2.5 GufOperator File. If the int_ext_flag field contains an "I," the src_number and net_type fields are used as pointers into the intnetheader file. If the int_ext_flag contains an "E," the src_number and net_type are used as pointers into the extnetheader and altnetheader files. The src_number, operator_id, and oper_number fields are used as pointers into the vehicle file to obtain the vehicle information for that operator. These same fields may be used as pointers in to the mfdcoperator file, if there are deployment constraints defined. See paragraphs 3.2.2.7 through 3.2.2.10 for a complete description of how to obtain the deployment constraints for an operator.

3.2.2.6 Vehicle File. Within the vehicle file, the src_number field is used as a pointer into the srcheader file to access complete information for the SRC that the operator is in. The src_number field may be used in combination with the operator_id and oper_number fields to access the gufooperator file to check nets and equipment associated with that operator. The src_number, operator_id, and oper_number fields are used as pointers in to the mfdcoperator file to obtain the deployment constraints, if any. The src_number field in this file can be

used as a pointer into the srcheader file to obtain other information on the SRC.

3.2.2.7 MfdcOperator File. The deploy_key field in the record pointed to should never be a "U", since this would mean that there is a random uniform distribution deployment in the area and there should be no deployment constraint records required. The src_number, operator_id, and oper_number fields may be used together as pointers into the vehicle file to obtain the vehicle information for that operator. These same fields may also be used to access net assignments and equipment assigned to these operators from the gufooperator file. To get complete deployment constraint information, the src_number, operator_id, and oper_number fields are used as pointers into the mfdcmainoper, mfdcreloper, or specopr files, depending upon what is contained in the operator_key field.

3.2.2.8 MfdcMainOper File. The src_number, operator_id, and oper_number fields in this file are used as pointers into the vehicle file to obtain the vehicle information for that operator. These same fields may be used to obtain net assignments and equipment assigned to these operators from the gufooperator file.

3.2.2.9 MfdcRelOper File. The src_number, operator_id, and oper_number fields in this file are used as pointers into the vehicle file to obtain the vehicle information for that operator. These fields may also be used to access net assignments and equipment assigned to these operators from the gufooperator file. The src_number, rel_oper_id, and rel_oper_num are used as pointers into the mfdcmainoper file to obtain the deployment constraints for that operator.

3.2.2.10 SpecOpr File. SpecOpr is an acronym used by CEOPS that means special operator distribution. The src_number, operator_id, and oper_number fields in this file are used as pointers into the vehicle file to obtain the vehicle information for that operator. These same fields may be used to obtain net assignments and equipment assigned to these operators from the gufooperator file.

3.2.2.11 CodeGroup File. There is a record in this file for each unique code group type. Any other file that has a code_group field can point to the same code group field in this file and retrieve the title, code_length, name_length, and class_req fields from the record pointed to.

3.2.2.12 Nomenclature File. The code_group field in this file may be used as a pointer into the codegroup file to obtain code_length of the code, nomen_length of the nomenclature, the title of the code_group, and whether or not there was a sec_class required for this code_group type. The code_group and code may be used as pointers into the description or linenums files to

obtain a further description or line_id_num of the code, if there is any.

3.2.2.13 Description File. The code_group field in this file may be used as a pointer into the codegroup file to obtain complete information for the given code_group type. The code_group and code fields may be used as pointers into the nomenclature file to obtain the nomenclature and sec_class of the record.

3.2.2.14 LineNumbs File. The code_group field in this file may be used as a pointer into the codegroup file to obtain complete information for the given code_group type. The code_group and code fields may be used as pointers into the nomenclature file to obtain the nomenclature and sec_class of the record.

3.2.2.15 Ptab File. The power and antenna table (PTAB) file yields a Boolean (yes/no, true/false) result when all four fields are specified in retrieval. When fewer fields are specified, the values returned in the unspecified fields represent coded identifiers. Complete information for the meq_code, vehicle_code, and ant_code fields can be obtained by using the field, with a code-group as a key into the linenums, description, and nomenclature files. Complete information for the comp_code field can be obtained from the description and nomenclature files in a similar manner. When obtaining complete information in this manner, a code_group of 33 is used with the meq_code field, a code_group of 35 for the comp_code field, a code_group of 40 for ant_code field, and a code_group of 92 for the vehicle_code field.

3.2.2.16 Config ref File. The config_ref file contains configuration references. The config field can be used to look up configuration definitions in the config_def file.

3.2.2.17 Config def File. The config_def file contains configuration definitions. The ecode field can be used to look up equipment definitions in the eqp_def file. The n field can be used to set a repetition count for creation of GUF-operator records.

3.2.2.18 Eqp def File. The eqp_def file contains equipment definitions for radio equipment items. The ccode field may be used to determine the value for the comp_code field when creating guf_operator records, and to look up component information in the comp_def file. The n field may be used to determine the number of records when creating guf_operator records.

3.2.2.19 Comp def File. The comp_def file contains component definitions. The emit_code field may be used to determine the emitter_code field when GUF-operator records are being created. The nomen and sec_class fields may be used similarly to the corresponding fields in the nomenclature table.

3.2.2.20 Eg Master File. The eq_master field contains the TOE header record information from VTAADS (fig 3).

3.2.2.21 Paragraph File. The paragraph file contains the paragraph header records from VTAADS. The toe_number and para_num fields may be used to look up information in the radios and vehicle files.

3.2.2.22 Personnel File. The personnel file contains information from the personnel records of VTAADS.

3.2.2.23 Equipment File. The equipment file contains information from the equipment records of VTAADS. The line_id_num field may be used to look up information in the linenumbs file.

3.2.2.24 Radios File. The radios file is a join of the equipment file with the linenumbs file, where code_group = 33.

3.2.2.25 Vehicles File. The vehicles file is a joint of the equipment file with the linenumbs file where code_group = 92.

3.3 Data Base File Design

3.3.1 SrcHeader File. The srcheader file contains one unique record for each SRC in the data base. The src_number field within this file is the key field that links all other records in the other files to a specific SRC (unit). This file currently contains 897 records stored in a binary tree (BTREE) structure.

3.3.1.1 SrcHeader Record. The srcheader record is 76 bytes long and contains five fields that are uniquely keyed on the src_number field.

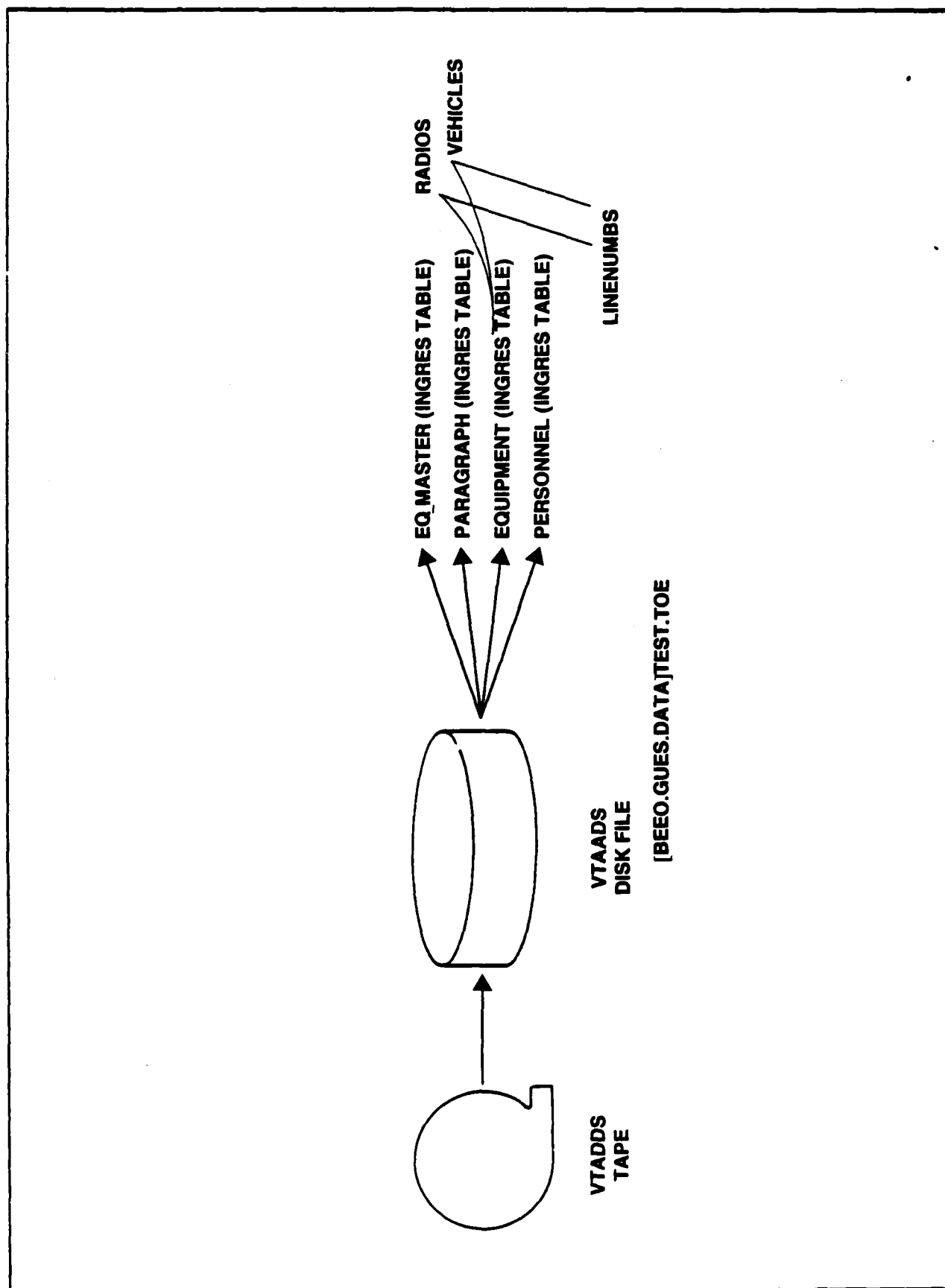


Figure 3. Present Scheme for VTAADS Record Processing

3.3.1.1.1 Secur Class Field. The secur_class field is a one alphanumeric ASCII character field. It designates the level of security applicable to the data associated with the SRC in this file. The valid entries are listed in the table 1.

TABLE 1. Security Classification Code

<u>Code</u>	<u>Classification</u>
0	UNCLASSIFIED
1	CONFIDENTIAL
2	SECRET
3	TOP SECRET
4	FOR OFFICIAL USE ONLY
5	CONFIDENTIAL NOFORN
6	SECRET NOFORN
7	TOP SECRET NOFORN
8	NATO CONFIDENTIAL
9	NATO SECRET
A	PROPRIETARY INFORMATION
B	CONFIDENTIAL US/UK EYES ONLY
C	SECRET US/UK EYES ONLY

3.3.1.1.2 SRC Number Field. The src_number field consists of 13 ASCII alphanumeric characters. The SRC number is based on Table of Organization and Equipment (TOE) numbers. The 13 characters are subdivided into the following seven items.

a. Characters 1-2 are alphabetic and represent the country of origin. (i.e., US = United States, GE = West Germany).

b. Characters 3-4 are numeric and represent the SRC base number. The base number indicates the branch or major subdivision of a TOE. (i.e., 11 = Signal, 17 = Armor).

c. Characters 5-7 are numeric and represent the SRC subnumber. The last digit of the subnumber describes the organizational level of the unit. (i.e., 5 = Battalion, 4 = Division).

d. The eighth character is alphabetic and represents the SRC suffix. It indicates the revision series.

e. The ninth character is numeric and represents the year of publication. It is derived from the last digit of the year the TOE was published.

f. Characters 10-11 are alphanumeric and represent the SRC variation code. It indicates the variations that apply to the organizational elements of the TOE.

g. Characters 12-13 are numeric and represent the SRC change number. This number is assigned by the TOE proponent and

denotes the applicable change that a TOE contains. Change number 99 denotes changes not yet published.

3.3.1.1.3 SRC Name Field. The `src_name` field is a 48 alphanumeric ASCII character field. This field contains the format name of the TOE unit associated with the SRC.

3.3.1.1.4 Deploy Key Field. The `deploy_key` (deployment key code) field is a one alphabetic ASCII character field. This field establishes whether the operators are to be placed randomly within the unit area, or placed individually according to the data in the MFDC. The valid entries are: U = to be placed randomly, or N = to be placed in accordance with the MFDC, however if not found, it will default to random deployment; S = placed in accordance with the MFDC and if not found output will terminate.

3.3.1.1.5 User ID Field. The `user_id` (user identification) field is a nine alphanumeric ASCII character field. It identifies the user currently working or the user who last worked the SRC represented by this record. This information is used to restrict other users from modifying any records associated with this SRC currently being worked on, and/or to identify the individual who created or last modified the SRC.

3.3.2 IntNetHeader File. The `intnetheader` file identifies the internal nets unique to a specific SRC. A net is considered internal to an SRC when the net control station (NCS) is provided by that SRC. This field currently contains 327 records stored in a BTREE structure.

3.3.2.1 IntNetHeader Record. The `intnetheader` record is 66 bytes long and contains nine fields that are uniquely keyed on the `src_number` and `net_type` fields.

3.3.2.1.1 SRC Number Field. For a description of the `src_number` field, see paragraph 3.3.1.1.2.

3.3.2.1.2 Net Type Field. The `net_type` field, composed of six alpha-numeric ASCII characters, identifies the type of net into which a particular communications equipment and operator will enter. An asterisk wildcard character may be used in the first, second, third, or sixth positions of this field. The net type number is subdivided into the following five subfields:

a. Subfield 1 is a one-character numeric field identifying the category of users establishing the net. Table 2 lists the valid net category numbers with the definitions.

TABLE 2. Category of Force Element Establishing the Net

<u>Number</u>	<u>Definition</u>
0	Reserved for future expansion
1	US ground forces
2	US air forces
3	NATO ground forces
4	NATO air forces
5	Reserved for future expansion
6	Enemy ground forces
7	Enemy air forces
8	Reserved for future expansion
9	Reserved for future expansion

b. Subfield 2 is a one-character alphanumeric field identifying the branch of an organization or a category of net. Table 3 lists the valid entries and their definitions.

TABLE 3. Branch or Category of Net

<u>Code</u>	<u>Branch or Category</u>
A	Armor
B	Air defense artillery
C	Chemical
D	Medical
E	Engineer
F	Field artillery
G	Military police
H	Composite
I	Infantry/rangers/light infantry
J	Military intelligence/communications electronics warfare and intelligence (CEWI)
K	Other
L	Airborne
M	Mechanized/motorized
N	Special forces
O	Ordnance
P	Psychological operations
Q	Quartermaster
R	Airmobile/air assault
S	Signal
T	Transportation
U	Aviation
V	Air Force
W	Marine
X	Navy
Y	Reserved for future expansion
Z	Reserved for future expansion
0	Reserved for future expansion

1 Reserved for future expansion
TABLE 3. Branch or Category of Net (continued)

<u>Code</u>	<u>Branch or Category</u>
2	Reserved for future expansion
3	Reserved for future expansion
4	Navigational aids
5	Non-RF
6	Radar
7	Satellites
8	Holding nets electronic warfare (reserved)
9	Multichannel

c. Subfield 3 is a one-character numeric field identifying the echelon of the organization establishing the net. Table 4 lists the valid entries for this subfield and their definition.

TABLE 4. Echelon Establishing the Net Type

<u>Code</u>	<u>Echelon establishing the type of net</u>
A	Corps area multichannel
0	Platoon, section, squad, team, detachment, flight
1	Company, troop, battery, air force squadron
2	Battalion, cavalry squadron
3	Regiment, group, wing
4	Brigade, support command
5	Division, or Div Multichannel/MSE or air division
6	Corps or Corps MSE, or tactical air force
7	Army
8	Theater Army
9	Unified/Special Command, Department of Defense
N	MSE node
M	MSRT-to-RAU

d. Subfield 4 is a one-character numeric field identifying the frequency range within which the net operates. When equipment has a tuning range that allows operation in more than one band, that band most coincident with the tunable range of the equipment should be used.

Table 5 lists valid codes for this subfield. The code number is even or odd, depending upon net type and purpose indicated in table 6.

TABLE 5. Frequency Range Bands for Net

<u>Code</u>	<u>Band</u>	<u>Frequency</u>	<u>Frequency Description</u>
0 or 1	I	3 kHz-1.99 MHz	Very Low Frequency (VLF), Low Frequency (LF), Medium Frequency (MF)
2 or 3	II	2 MHz-19.99 MHz	High frequency (HF)
4 or 5	III	20 MHz-244.99 MHz	Very high frequency (VHF)
6 or 7	IV	225 MHz-2.99 GHz	Ultrahigh frequency (UHF),
8 or 9	V	3 GHz-300 GHz	Super high frequency (SHF), Extremely high frequency (EHF)

e. Subfield 5 is a two-character alphanumeric field identifying the function of the net. Table 6 lists the valid codes and the associated function. If subfield 4 is odd, the function under the odd number column is appropriate; and if it is even, the even number column is appropriate.

TABLE 6. Primary Purpose of the Net

<u>Code</u>	<u>Even number</u>	<u>Odd number</u>
00 - 10	Command/operations	Operations
11 - 20	Operations/intelligence	Intelligence
21 - 30	Administration/logistics	Reserved for expansion
31 - 35	Fire direction	Radio wire integration
36 - 39	reserved	Reserved
40 - 49	Direction finding/	Area communications jamming/intercept/ other EW
50 - 99	Hold Nets	Air traffic control

3.3.2.1.3 Net Name Field. The net_name field is a 28 alphanumeric ASCII character field. It may be any valid character string and must be left-justified. This field is the name of the net plus an indication of its function and echelon.

3.3.2.1.4 Mod Code Field. The mod_code (modulation code) field is a five numeric ASCII character field. It designates the RF modulation type which the net type most habitually operates. The valid codes and their meanings are contained in the nomenclature file.

3.3.2.1.5 Num Channels Field. The num_channels (number of channels) field is a three numeric ASCII character field. It designates the number of channels for a multichannel net. It is blank for single-channel nets.

3.3.2.1.6 Pulse Rep Rt Field. The pulse_rep_rt (pulse repetition rate) field is a four-byte floating point field and represents the pulse rate of the equipment in pulses per second (p/s).

3.3.2.1.7 Pulse Width Field. The pulse_width field is a four-byte floating point field that indicates the pulse in tenths of microseconds.

3.3.2.1.8 Protect Freq Field. The protect_freq (protected frequency) field is a one alphabetic ASCII character field. The only valid entries are P for protected frequencies and blank for non-protected frequencies.

3.3.2.1.9 Net Function Field. The net_function field is a one alphabetic ASCII character field designating the primary function for which the net is used. The valid entries and their meanings are listed in the table 7.

TABLE 7. Functional Coding for Nets

<u>Code</u>	<u>Function</u>
R	Command/Operations
2	Operations
F	Intelligence
U	Operations/Intelligence
K	Administration/Logistics
0	Fire Direction
7	Air Traffic Control
D	EW Direction Finding/Jamming/ Intercept/Other EW
N	Radio Wire Integration
P	Area Communication
H	Spare/Hold Net

3.3.3 ExtNetHeader File. The extnetheader file identifies external nets unique to a specific SRC. A net is considered external when the NCS for the net is provided by a different SRC. This file currently contains 4629 records stored in an BTREE structure.

3.3.3.1 ExtNetHeader Record. The 34-byte extnetheader record contains four fields that are uniquely keyed on the src_number and net_type fields.

3.3.3.1.1 SRC Number Field. For a description of the src_number field, see paragraph 3.3.1.1.2.

3.3.3.1.2 Net Type Field. For a description of the net_type field, see paragraph 3.3.2.1.2.

3.3.3.1.3 NIC Code Field. The nic_code (net information code) field is a two alphanumeric ASCII character field. This field indicates the relationship between the unit to which the operator belongs and the unit providing the net control station (NCS) for the external net that the operator will join. The valid entries and their meaning are listed in table 2-13, Unit Subordination Codes, in Description of the CEOPS Data Base Files.

3.3.3.1.4 Ext SRC Num Field. The ext_src_num field designates the SRC that serves as the NCS for the external net listed. For a description of the SRC field see paragraph 3.3.1.1.2.

3.3.4 AltNetHeader File. The altnetheader file contains alternate nets that are associated with a specific external net in the extnetheader file. There may be up to eight alternate nets for each primary external. The key fields that link the two files are the src_number and net_type. This file currently contains 5424 records stored in a BTREE structure.

3.3.4.1 AltNetHeader Record. The altnetheader record is 39 bytes long and contains five fields that are uniquely keyed on the src_number, net_type, and alt_order fields.

3.3.4.1.1 SRC Number Field. For a description of the src_number field, see paragraph 3.3.1.1.2.

3.3.4.1.2 Net Type Field. For a description of the net_type field, see paragraph 3.3.2.1.2.

3.3.4.1.3 Alt Order Field. The alt_order field is a one numeric ASCII character field which designates the order of priority of alternate external nets. There is a limit of eight alternates per primary net, therefore, the valid entries are 1-8.

3.3.4.1.4 Alt Net Type Field. For a description of the alt_net_type field, see paragraph 3.3.2.1.2.

3.3.4.1.5 Alt SRC Num Field. For a description of the alt_src_num field, see paragraph 3.3.1.1.2.

3.3.5 GufOperator File. The gufoperator file identifies each unique operator within a specific external or internal net, within a specific SRC. It also defines the radio frequency (RF) emitters and receivers used by the operator. This file currently contains 22653 records stored in a BTREE format.

3.3.5.1 GufOperator Record. The gufoperator record is 52 bytes long and contains 17 fields that are uniquely keyed on the src_number, net_type, int_ext_flag, operator_id, oper_number, and emitter_code fields.

3.3.5.1.1 SRC Number Field. For a description of the src_number field, see paragraph 3.3.1.1.2.

3.3.5.1.2 Net Type Field. For a description of the net_type field, see paragraph 3.3.2.1.2.

3.3.5.1.3 Int Ext Flag Field. The int_ext_flag field is a one numeric ASCII character field which identifies the associated net as either internal or external. Valid entries are "I" for internal, or "E" for external.

3.3.5.1.4 NCS Code Field. The ncs_code (net contrc' station) field is a one numeric ASCII character field which designates the operator and his equipment as either the NCS or an operator in the net. The valid entries are; 0 for NCS, 1 for an operator whose NCS is an external operator, 2 for the external operator who serves as the NCS, and 3 for a normal operator in the net.

3.3.5.1.5 Line Number Field. The line_number field is a six alphanumeric ASCII character field. The number is obtained from the TOE or a supply document, and is used within the military as an equipment identifier.

3.3.5.1.6 Para Number Field. The para_number field is a two alphanumeric ASCII character field. The field indicates the paragraph number within the TOE for the operator and equipment.

3.3.5.1.7 Mult Net Ent Field. The mult_net_ent (multiple net entry) field is a one numeric ASCII character field. This field identifies the number of nets an operator and specific piece of equipment will enter. This field is normally left blank, which indicates it will operate in only one net.

3.3.5.1.8 Alloc Code Field. The alloc_code (allocation) field is a one numeric ASCII character field. This field indicates what processing will be done for an operator who cannot be assigned to an external net through information contained in the NIC field. Valid entries are: 0 = the operator must be assigned manually if automatic assignment fails, 1 = the operator must be assigned if the NIC relationship exists, and 2 = the operator need not be assigned if automatic assignment fails.

3.3.5.1.9 Operator ID Field. The operator_id field is a four-numeric coded ASCII character field identifying the operator of a piece of RF equipment. The meaning of the codes are contained in the nomenclature file and only codes contained in that file are valid entries.

3.3.5.1.10 Oper Number Field. The oper_number field is a two alphanumeric ASCII character field used to further identify like operators within the same SRC. As an example: three platoon leaders in the same unit would be 01, 02, and 03. Valid entries are 00-99, and A0-Z9.

3.3.5.1.11 Meq Code Field. The meq_code (major equipment) field is a three alphanumeric ASCII character field. It is a coded field that identifies the major pieces of equipment. The meaning

of the codes are contained in the nomenclature file, and only the codes in this file are valid entries.

3.3.5.1.12 Comp Code Field. The comp_code (component) field is a three alphanumeric ASCII character field. It is a coded field that identifies a component of a major piece of equipment. The meaning of the codes are contained in the nomenclature file, and only the entries in this file are considered valid entries.

3.3.5.1.13 Emitter Code Field. The emitter_code field is a one alphabetic ASCII character field which describes the functioning of a piece of RF equipment. The following table lists the valid entries and their meaning.

TABLE 8. Emitter/Receptor/Target/Sensor Code

<u>Code</u>	<u>Equipment</u>
X	RF communication transmitter
R	RF communications receiver
T	RF communication transceiver
J	RF jammer
I	RF intercept receiver
D	RF direction finding (DF) receiver
K	Rf receiver component of a jammer equipment
F	RF intercept and DF receiver
G	RF jammer transceiver
W	RF warning receiver
Z	RF self-defense jammer
C	Radar
M	Radar image target
H	IR target (heat emitter)
Q	IR sensor or DF
V	Visual target
P	Photographic sensor
L	Low light level sensor or DF
B	Visual sensor (glasses)
S	Visual sensor (unaided vision)
A	Audio
E	Unaided audio sensor or DF
N	Audio sensor or DF aided by amplification

3.3.5.1.14 Sys ID Code Field. The sys_id_code (system identification) field is a two alphanumeric ASCII field. This field further identifies major equipment as part of a system, such as TACFIRE. The codes and their meanings for this field can be found in the nomenclature file; these are the only valid codes.

3.3.5.1.15 Comsec Code Field. The comsec_code (communication security) field is a two alphanumeric ASCII character field that identifies Comsec equipment. The valid codes and their meanings can be found in the nomenclature file.

3.3.5.1.16 Ant Code Field. The ant_code (antenna) field is a three alphanumeric ASCII character field that identifies an antenna. The valid codes and their meanings can be found in the nomenclature file.

3.3.5.1.17 Equip Seq Field. The equip_seq field is a one-byte integer field containing the equipment sequence number. This field may be used with the meq_code field to uniquely identify a major equipment item used by a specific operator. Equipment is sequenced in numerical order.

3.3.6 Vehicle File. The vehicle file identifies each unique operator within an SRC and the vehicle he is associated with. This field currently contains 22780 records stored in an BTREE structure.

3.3.6.1 Vehicle Record. The vehicle record is 27 bytes long and contains six fields that are uniquely keyed on the src_number, operator_id, and oper_number fields.

3.3.6.1.1 SRC Number Field. For a description of the src_number field, see paragraph 3.3.1.1.2.

3.3.6.1.2 Operator ID Field. For a description of the operator_id field, see paragraph 3.3.5.1.9.

3.3.6.1.3 Oper Number Field. For a description of the oper_number field, see paragraph 3.3.5.1.10.

3.3.6.1.4 Vehicle Code Field. The vehicle_code field is a three alphanumeric ASCII field that identifies a vehicle. The valid codes and their meanings can be found in the nomenclature file.

3.3.6.1.5 Veh Config Field. The veh_config (vehicle configuration) field is a three alphanumeric ASCII field that identifies specific radio configurations for certain vehicles. The valid codes and their meanings can be found in the nomenclature file.

3.3.6.1.6 Vehicle Seq Field. The vehicle_seq field is a three numeric ASCII character field. All vehicles within an SRC are sequentially numbered utilizing this field. Valid entries are 001-999.

3.3.7 MfdcOperator File. The mfdcoperator file identifies each unique operator within a specific SRC and assigns an operator key code to each operator. Based on the operator key code, the operator deployment constraints will be obtained from one of the fol-

lowing three files; mfdcmainoper, mfdcreloper, or specopr. This file currently contains no records stored in a BTREE structure.

3.3.7.1 MfdcOperator Record. The mfdcoperator record is 22 bytes long and contains five fields that are uniquely keyed on the src_number, operator_id, and oper_number fields.

3.3.7.1.1 SRC Number Field. For a description of the src_number field, see paragraph 3.3.1.1.2.

3.3.7.1.2 Operator Key Field. The operator_key field is a one alphabetic ASCII character field which defines the way the operator is deployed. The valid entries and their meanings are listed in table 2-14, Operator Key Codes, in Description of the CEOPS Data Base Files.

3.3.7.1.3 Operator ID Field. For a description of the operator_id field, see paragraph 3.3.5.1.9.

3.3.7.1.4 Oper Number Field. For a description of the oper_number field, see paragraph 3.3.5.1.10.

3.3.7.1.5 Subtroop Num Field. The subtroop_num field is a one numeric ASCII field. The field is used to further define subordinate elements of an existing SRC for deployment purposes. Valid entries are 1-9.

3.3.8 MfdcMainOper File. The mfdcmainoper file has a record for each operator within an SRC that has his own set of deployment constraints. These operators are referred to as main operators. This file currently contains one record stored in a BTREE structure.

3.3.8.1 MfdcMainOper Record. The mfdcmainoper record is 39 bytes long and contains 11 fields that are uniquely keyed on the src_number, operator_id, oper_number, and posture_code fields.

3.3.8.1.1 SRC Number Field. For a description of the src_number field, see paragraph 3.3.1.1.2.

3.3.8.1.2 Operator ID Field. For a description of the operator_id field, see paragraph 3.3.5.1.9.

3.3.8.1.3 Oper Number Field. For a description of the operator_num field, see paragraph 3.3.5.1.10.

3.3.8.1.4 Posture Code Field. The posture_code field is a one alphabetic ASCII character field which defines the activity level of the unit to which the operator belongs. Table 9 lists the valid entries and their meanings.

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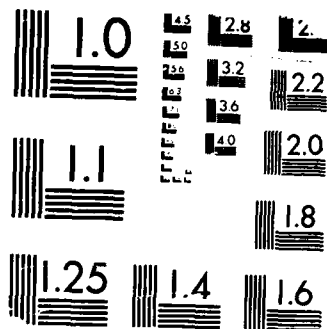
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TABLE 9. Unit Posture Codes

<u>Code</u>	<u>Posture</u>
R	Reserve
C	No contact
L	Light combat
S	Second echelon
M	Moderate combat
H	Heavy combat
P	Priority combat
W	Nuclear warning
D	Nuclear delivery

3.3.8.1.5 Activ Code Field. The activ_code (activity) field consists of one alphanumeric ASCII character. This field defines the type of activity or operation in which a unit is engaged. This field is intended to function as a modifier of the unit posture_code whenever the posture_code factor appears inadequate to reflect the traffic loading expected in some special or unusual type of scenario-oriented situation. Table 10 lists the valid entries with the associated meaning.

TABLE 10. Unit Activity Codes

<u>Code</u>	<u>Description of Activity</u>
O	Activity not applicable; i.e., needline not qualified by an activity indicator
A	Attacking, counter-attacking, or reconnoitering in force
B	Conducting exploitation or pursuit
C	Defending, delaying, or screening
D	Conducting passage of lines (moving unit) or relief in place (relieved unit)
E	Conducting passage of lines (stationary unit) or relief in place (relieved unit)
F	Marching (road or cross-country march)
G	Moving to contact
H	Part of covering force
J	Clearing minefield or obstacle
K	Crossing minefield
L	Crossing river
M-Z	Reserved for future use

3.3.8.1.6 Width Dist Field. The width_dist (width distribution) field is a one alphabetic ASCII character field. This field describes the type of distribution used to position the operators. For valid entries and their meanings, see table 2-14, Distribution Codes and Parameters, in Description of the CEOPS Data Base Files.

3.3.8.1.7 Width Param1 Field. The width_param1 (first width parameter) field is a six numeric ASCII character field. The entries for this field are dependent on the Width Distribution Code, and are described in table 2-14 in Description of the CEOPS Data Base Files.

3.3.8.1.8 Width Param2 Field. For a description of the width_param2 (second width parameter) field, refer to paragraph 3.3.8.1.7.

3.3.8.1.9 Depth Dist Field. For a description of the depth_dist (depth distribution) field refer to paragraph 3.3.8.1.6.

3.3.8.1.10 Depth Param1 Field. For a description of the depth_param1 (first depth parameter) field, refer to paragraph 3.3.8.1.7.

3.3.8.1.11 Depth Param2 Field. For a description of the depth_param2 (second depth parameter) field refer to paragraph 3.3.8.1.7.

3.3.9 MfdcRelOper File. The mfdcRelOper file contains a record for each operator within an SRC who is deployed in accordance with the constraints given to a main operator. These operators are referred to as related operators and are linked to a main operator in the mfdcmainoper file by the src_number, rel_oper_id, and rel_oper_num fields. This field currently contains no records stored in a BTREE structure.

3.3.9.1 MfdcRelOper Record. The mfdcRelOper record is 25 bytes long and contains five fields that are uniquely keyed on the src_number, operator_id, and oper_number fields.

3.3.9.1.1 SRC Number Field. For a description of the src_number field, see paragraph 3.3.1.1.2.

3.3.9.1.2 Operator ID Field. For a description of the operator_id field, see paragraph 3.3.5.1.9.

3.3.9.1.3 Oper Number Field. For a description of the oper_number field, see paragraph 3.3.5.1.10.

3.3.9.1.4 Rel Oper ID Field. For a description of the rel_oper_id (related operator ID) field, see paragraph 3.3.5.1.9.

3.3.9.1.5 Rel Oper Num Field. For a description of the rel_oper_num (related operator number) field, see paragraph 3.3.5.1.10.

3.3.10 SpecOpr File. The specopr file identifies operators within an SRC that are to be deployed with another SRC (unit). This operator is also considered a main operator and is listed in the mfdcmainoper file with his deployment constraints. This file (specopr) contains the primary and up to five alternate SRC's that the operator could be deployed with. This file currently contains no records stored in a BTREE structure.

3.3.10.1 SpecOpr Record. The specopr record is 37 bytes long and contains seven fields that are uniquely keyed on the src_number, operator_id, oper_number, and mu_order fields.

3.3.10.1.1 SRC Number Field. For a description of the src_number field, see paragraph 3.3.1.1.2.

3.3.10.1.2 Operator ID Field. For a description of the operator_id field, see paragraph 3.3.5.1.9.

3.3.10.1.3 Oper Number Field. For a description of the oper_number field, see paragraph 3.3.5.1.10.

3.3.10.1.4 URC Code Field. For the description of the urc_code (unit relationship code) field, see paragraph 3.3.3.1.3. The urc_code field and the nic_code field are identical.

3.3.10.1.5 OAC Code Field. The oac_code (operator assignment code) field is a two alphanumeric ASCII character field. This field establishes the rules for assigning operators to units that match both the URC and SRC given in the previous fields. The field is divided into two subelements as follows.

3.3.10.1.5.1 The first subelement can be one of the following:

- S Assigns the operators sequentially to the valid move troops. If there are more operators than move troops, the extra stay with the parent unit.
- C Assigns the operators sequentially to the valid move troops. If there are more operators than move troops than the sequential assignment continues until all operators are assigned.
- G The operator must have specific assignment instructions.
- D Divides the operators among the valid move troops.

3.3.10.1.5.2 The second subelement is numeric, and identifies the number of operators to be assigned to each move troop. This number is used only with 'S' above.

3.3.10.1.6 MU Order Field. The mu_order (move unit order) field is a one numeric ASCII character field which indicates the order of priority of move units. There is a limit of five move units, therefore, valid entries are 1-5.

3.3.10.1.7 MU SRC Num Field. For a description of the mu_src_num (move unit SRC number) field, see paragraph 3.3.1.1.2.

3.3.11 CodeGroup File. This file describes the various code groups contained in the nomenclature file. There are currently 16 records stored in this file.

3.3.11.1 CodeGroup Record. The codegroup record is 29 bytes long and contains five fields that are uniquely keyed on the code_group field.

3.3.11.1.1 Code Group Field. The code_group field is a two numeric ASCII character field. This field provides the numeric representation of the type codes contained in the nomenclature file. Example: 01 = Operators, 92 = Vehicles. There are currently 16 unique code groups in this file. These are shown in table 12.

TABLE 11. Code Group Table

<u>Group</u>	<u>Title</u>	<u>Length</u>	<u>Nomen</u>	<u>Class</u>
01	Operator Name	4	15	N
33	Major Equipment (MEQ)	3	24	Y
35	Component (CMP)	3	24	Y
40	Antenna (ANT)	3	24	Y
42	Ant Polarization (POL)	1	24	N
44	Emitter/Receptor (EMT)	1	24	N
46	Posture (POS)	1	25	N
47	Data Sets (DS)	1	35	N
50	Modulation (MOD)	5	52	N
52	Antenna Directivity	1	24	N
60	Comm Security Equip	2	17	N
65	System Identification	2	15	N
66	Net Function (FUNCT)	1	24	N
80	Security (SEC)	1	28	N
87	Equipment Status (STA)	1	40	N
92	Vehicle (VEH)	3	40	Y

3.3.11.1.2 Title Field. The Title field is a 24 alphanumeric ASCII character field which provides the plain english title of the various code groups.

3.3.11.1.3 Code Length Field. The code_length field is a one numeric ASCII character field which provides the numeric length of the code field of the various type codes.

3.3.11.1.4 Nomen Length Field. The nomen_length field is a two numeric ASCII character field which provides the numeric length of the nomenclature field of the various type codes.

3.3.11.1.5 Class Req Field. The class_req field is a one alphabetic ASCII character field. This field states whether the various type codes could possibly be classified.

3.3.12 Nomenclature File. This file contains all the codes and their meanings. Only the codes contained in this file are considered valid.

3.3.12.1 Nomenclature Record. The nomenclature record is 62 bytes long and contains four fields that are uniquely keyed on the code_group and code fields.

3.3.12.1.1 Code Group Field. For a description of the code_group field, see paragraph 3.3.11.1.1.

3.3.12.1.2 Code Field. The code field is a five alphanumeric ASCII character field. This field contains the codes that are used in the coding of GUF records. Only the codes contained in this field are considered valid.

3.3.12.1.3 Nomenclature Field. The nomenclature field is 52 alphanumeric ASCII character field which contains the plain english representation of the code field.

3.3.12.1.4 Sec Class Field. For a description of the sec_class field, see paragraph 3.3.1.1.1.

3.3.13 Description File. This file contains a plain english description of some of the coded items. Not all coded items require a description; the nomenclature field is sufficient.

3.3.13.1 Description Record. The description record is 264 bytes long and contains three fields that are uniquely keyed on the code_group and code fields.

3.3.13.1.1 Code Group Field. For a description of the code_group field, see paragraph 3.3.11.1.1.

3.3.13.1.2 Code Field. For description of the code field, see paragraph 3.3.13.1.2.

3.3.13.1.3 Description Field. The description field is a 255 alphanumeric ASCII character field which provides a plain english description of appropriate coded items.

3.3.14 LineNumbs File. The linenumbs file contains a record for each item in the nomenclature file that can be identified by a line identification number.

3.3.14.1 LineNumbs Record. The linenumbs record is 13 bytes long and contains three fields that are uniquely keyed on the code_group and code fields.

3.3.14.1.1 Code Group Field. For a description of the code_group field, see paragraph 3.3.11.1.1.

3.3.14.1.2 Code Field. For a description of the code field, see paragraph 3.3.11.1.2.

3.3.14.1.3 Line ID Num Field. The line_id_num (line identification number) field contains line number from the TOE or other supply documents, that identifies the associated piece of equipment.

3.3.15 Ptab File. This file provides all the possible legal combinations of major equipments, components, antennas, and vehicles. This file currently contains 4080 records that are 12 bytes long and is stored in an BTREE structure that is uniquely keyed on the meq_code, comp_code, ant_code, and vehicle_code fields.

3.3.15.1 Ptab Record. The ptab record is 12 bytes long and contains four fields that are uniquely keyed on the meq_code, comp_code, ant_code, and vehicle_code fields.

3.3.15.1.1 Meq Code Field. For the description of the meq_code field, see paragraph 3.3.5.1.11.

3.3.15.1.2 Comp Code Field. For a description of the comp_code field, see paragraph 3.3.5.1.12.

3.3.15.1.3 Ant Code Field. For a description of the ant_code field, see paragraph 3.3.6.1.4.

3.3.15.1.4 Vehicle Code Field. For a description of the vehicle_code field, see paragraph 3.3.6.1.4.

3.3.16 Config ref File. This file contains a single record for each legal combination of a vehicle with one or more major equipment items. The records in the file are 53 bytes long and are stored in an ISAM structure that is uniquely keyed on the vcode and config fields.

3.3.16.1 Vcode Field. See paragraph 3.3.6.1.4.

3.3.16.2 Config Field. The config field is a 50-alphanumeric text field that identifies a particular configuration of radios. The current convention is that the config is formed by combining a string for each meq_code (para 3.3.5.1.11). The strings are formed from the meq_code with a numeric count prefix when the count is greater than one.

3.3.17 Config def File. This record contains one record for each kind of major equipment item that is included in a particular vehicle configuration. The file currently contains 970 records that are stored in an ISAM structure uniquely keyed on config and ecode.

3.3.17.1 Config Field. See paragraph 3.3.16.2.

3.3.17.2 Ecode Field. The ecode field is the meq_code field (para 3.3.5.1.11).

3.3.18 Eqp def File. The eqp_def file contains one or more records for every defined value of the major equipment code. There is one record for each kind of component that is contained

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in the major equipment item. This file currently contains 437 10-byte records stored in a hash structure and indexed on ecode.

3.3.18.1 Ecode Field. See paragraph 3.3.5.1.11.

3.3.18.2 Ccode Field. See paragraph 3.3.5.1.12.

3.3.18.3 N Field. The n field is a one-byte positive nonzero integer field signifying the number of a particular component included in a major equipment item.

3.3.19 Comp def File. The comp_def file contains a single record for every defined type of component. This file currently contains 294 57-byte records stored in a BTREE structure that is keyed uniquely on code.

3.3.19.1 Code Field. See paragraph 3.3.5.1.12.

3.3.19.2 Emit code Field. See paragraph 3.3.5.1.13.

3.3.19.3 Nomen Field. See paragraph 3.3.12.1.3.

3.3.19.4 Class Field. See paragraph 3.3.12.1.4.

3.3.20 Eq master File. The eq_master file contains selected TOE header records from VTAADS. The format of TOE header, paragraph, equipment, and personnel records is shown in figure 4. The file contains five 60-byte records stored in a heap.

3.3.20.1 TOE Number Field. The field contains characters 3-11 of the SRC number (para 3.3.1.1.2.6). TOE number is stored in ASCII format.

3.3.20.2 Title Field. This 47-character field contains the TOE title.

3.3.20.3 Rtype Field. The rtype field is the single-character "A" for record type.

3.3.20.4 SecurClass Field. The secur_class field is a one-character security code, normally "U" for unclassified.

3.3.21 Paragraph File. The paragraph field contains the VTAADS paragraph header records. There are currently 31 35-byte records stored in a heap.

3.3.21.1 TOE number Field. See paragraph 3.3.20.1.

3.3.21.2 Para num Field. The para_num field is a two-character numeric paragraph number with leading zeroes; it is stored in ASCII format.

3.3.21.3 Title Field. The title field is a 21-character paragraph title.

3.3.21.4 Rtype Field. The rtype field is a single ASCII character record type; it is always "B."

3.3.22 Personnel File. The personnel file contains the VTAADS personnel records with selected fields. There are currently 202 43-byte records stored in a compressed heap.

3.3.22.1 TOE number. See paragraph 3.3.20.1.

3.3.22.2 Para num Field. See paragraph 3.3.21.2.

3.3.22.3 Title Field. This field is a 22-character title.

3.3.22.4 Grade Field. This field is a 2-character ASCII code denoting grade or rank, such as E7.

3.3.22.5 MOS Field. This field is a 5-character description indicating military occupational specialty.

3.3.22.6 Kount Field. This field is a one-byte positive nonzero integer indicating the number of personnel of this title when the unit is at full strength level.

3.3.23 Equipment File. This file contains the VTAADS equipment records. There are currently 276 68-byte-long records stored in a hash structure. Nonradio equipment is included.

3.3.23.1 TOE number Field. See paragraph 3.3.20.2.

3.3.23.2 Para num Field. See paragraph 3.3.21.2.

3.3.23.3 Nomenclature Field. This field is a 34-character nomenclature naming the equipment item.

3.3.23.4 Kount Field. This field is a one-byte integer indicating the count for this particular equipment item in a specific paragraph when the unit is at full strength.

3.3.23.5 Line id num Field. See paragraph 3.3.14.1.3.

3.3.23.6 Kind Field. This field is a 12-character description which indicates whether an equipment item is a vehicle, COMSEC, radio/radar, or other. The legal values of this field are COMSEC, VEHICLE, RADIO/RADAR, and OTHER.

3.3.24 Radios File. This file is a view. See paragraph 3.3.2.2.4.

3.3.24.1 TOE Number. See paragraph 3.3.20.2.

3.3.24.2 Para num Field. See paragraph 3.3.21.2.

3.3.24.3 Nomenclature Field. See paragraph 3.3.1.23.3.

3.3.24.4. Kount Field. See paragraph 3.3.23.4.

DBDD-C005T004D7

3.3.24.5 Code Field. This field is the major equipment code. See paragraphs 3.3.5.1.11 and 3.3.12.1.2.

3.3.24.6 Line id num Field. See paragraph 3.3.14.1.3.

3.3.25 Vehicle File. This file is a view. See paragraph 3.2.2.5.

3.3.25.1 TOE number Field. See paragraph 3.3.20.2.

3.3.25.2 Para num Field. See paragraph 3.3.21.2.

3.3.25.3 Nomenclature Field. See paragraph 3.3.23.3.

3.3.25.4 Kount Field. See paragraph 3.3.22.6.

3.3.25.5 Code Field. See paragraphs 3.3.12.1.2.

3.4 Data Base References. To be determined.

6. NOTES

6.1 Abbreviations and Acronyms. The following is a list of abbreviations and acronyms used in this document.

BTO	Bell Technical Operations
CEOPS	Communications-Electronics Operator Positioning System
Comsec	Communications Security
CEWI	Communications, Electronic Warfare, and Intelligence
CSCI	Computer Software Configuration Item
DBDD	Data Base Design Document
Equal	Embedded QUEL
EW	electronic warfare
GDB	Generic Data Base
GDES	Generic Data Entry System
GHz	gigahertz
GUES	Generic Unit Entry System
GUF	Generic Unit File
HF	high frequency
INGRES	Interactive Graphics and Retrieval System
IR	infrared
LF	low frequency
MEQ	Major Equipment
MF	medium frequency
MFDC	Master File of Deployment Constraints
MSE	Mobile Subscriber Equipment
MU	Move Unit
NCS	Net Control Station
NIC	Net Information Code
OAC	Operator Assignment Code
Ptab	Power and Antenna Table
QUEL	Query Language
RF	Radio Frequency
RTI	Relational Technology, Inc.
SHF	super high frequency
SpecOpr	Special Operator Distribution
SRC	Standard Requirements Code
TOE	Table(s) of Organization and Equipment
UHF	ultra high frequency
URC	Unit Relationship Code
USAEPG	US Army Electronic Proving Ground
VHF	very high frequency
VLF	very low frequency
VTAADS	VERTICAL, the Army Authorized Document System

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